IUC ACADEMY

INCLUSIVE UNIVERSAL CAREERS ACADEMY

Learn. Prepare. Progress. • www.iucacademy.com

IUC ACADEMY NOTES

Complete Syllabus • Conceptual Flowcharts • Comparative Tables • Solved Practice Questions

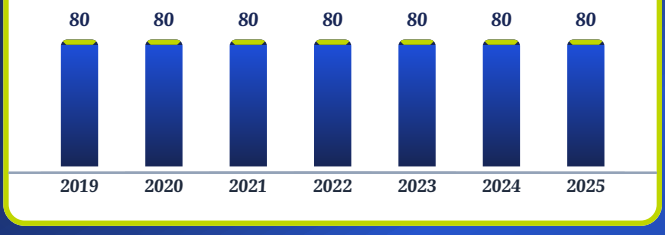
CSAT COMPREHENSIVE APTITUDE, REASONING & RC — STUDY NOTES

Number System, Permutations & Combinations, Probability, Quantitative Arithmetic, Logical & Analytical Reasoning, Reading Comprehension, Data Interpretation & Data Sufficiency for UPSC Paper-II & State PCS

Topic-Wise Exam Weightage Distribution (%)



Previous Years' Question Trend Analysis



Target Competitive, Entrance & Departmental Examinations

UPSC CSE Paper-II (CSAT) • UPPSC/BPSC/MPPSC/RAS CSAT • UPSC EPFO • State Civil Services Prelims

Core Syllabus Pillars & Exam Question Weightage (%)

- Number System, Remainders, Divisibility, P&C and Probability (30%)
- Reading Comprehension: Inference, Assumption, Corollary & Crux (32%)
- Quantitative Arithmetic: Percentage, Ratio, Time-Work, Speed-Distance (18%)
- Logical & Analytical Reasoning: Syllogism, Seating, Clocks & Calendars (12%)
- Data Interpretation (Tables, Pie, Bar) & 2/3-Statement Data Sufficiency (8%)

Complete Theory
NCERT & Official Sources

Visual Flowcharts
Comparative Matrices

Memory Tricks
Exam Trap Alerts

75+ Solved MCQs
One-Liner Capsules

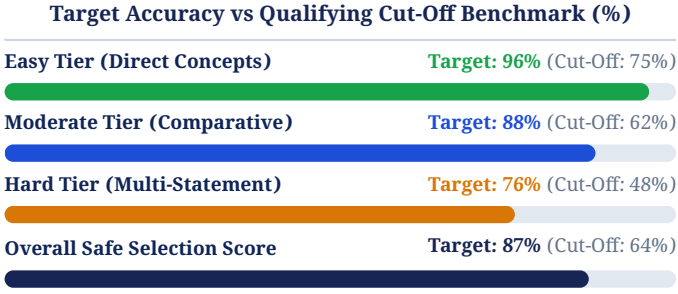
Preface, Exam Weightage Dashboard & Study Strategy — CSAT COMPREHENSIVE APTITUDE, REASONING & RC — STUDY NOTES

IUC Academy (Inclusive Universal Careers Academy | www.iucacademy.com) • Official English Medium Study Notes

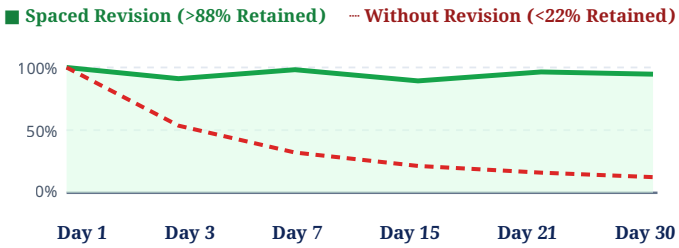
Dear Aspirants,

Modern competitive, entrance, and departmental promotion examinations demand a combination of deep conceptual clarity, statutory precision, and rapid revision tools. Prepared by **Inclusive Universal Careers Academy (IUC Academy — www.iucacademy.com)**, these comprehensive English-medium study notes integrate **structured chapter theory, 4-node conceptual process flowcharts, multi-column comparative tables, inline mathematical/scientific formulas, 'Did You Know?' boxes, 'Exam Trap Alert' callouts, 'Memory Trick' mnemonics, Chapter-End Analytical Synthesis Matrices, 75+ Step-by-Step Solved MCQs, and Rapid-Fire One-Liner Revision Capsules**.

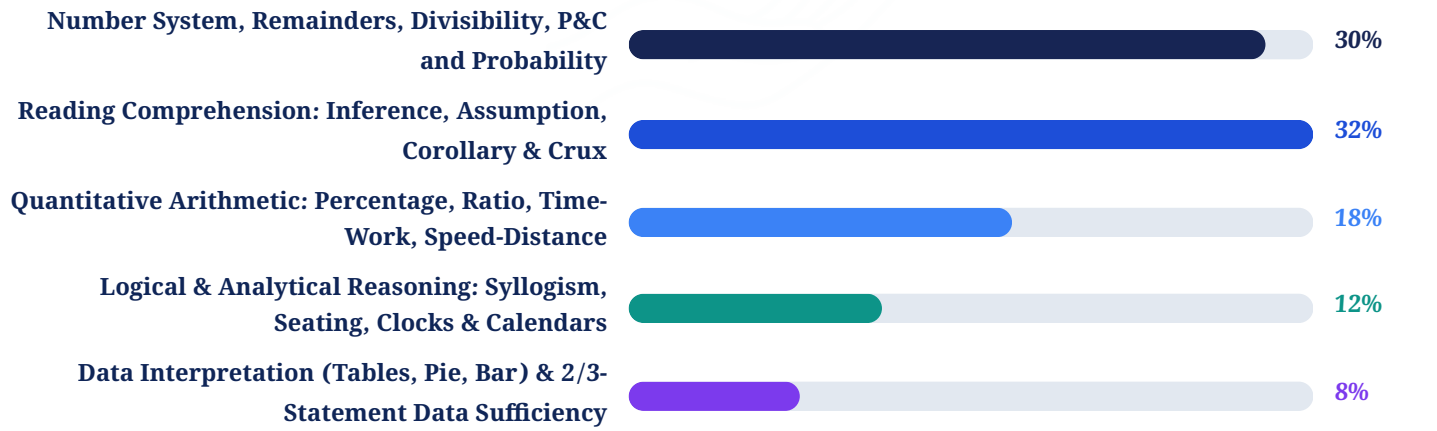
Target Accuracy vs Qualifying Cut-Off Benchmark (%)



Spaced Revision (1-3-7-21 Day Rule) & Retention Curve



Topic-Wise Exam Question Weightage Index (%)



Verified Official Curriculum & Statutory Reference Portals

- UPSC Official Portal (https://upsc.gov.in/)
- NCERT Mathematics Textbooks (https://ncert.nic.in/textbook.php)
- SSC Official Portal (https://ssc.gov.in/)
- IUC Academy Official Portal (https://www.iucacademy.com)

Detailed Table of Contents & Chapter Architecture

CSAT COMPREHENSIVE APTITUDE, REASONING & RC — STUDY NOTES • Complete Chapters, Comparative Matrices, Solved MCQs & Rapid Revision

1. Chapter 1: Number System, Divisibility, Remainder Theorems & Base System Arithmetic

- 1.1 Classification of Numbers, Prime Properties & Divisibility Frameworks
- 1.2 Remainder Theorems, Cyclicity of Unit Digits & Trailing Zeros

2. Chapter 2: Percentages, Profit-Loss, Interest, Ratios, Mixtures & Time-Work-Distance

- 2.1 Percentage Equivalences, Successive Changes & Profit-Loss Mechanics
- 2.2 Simple & Compound Interest, Alligation, Time-Work & Relative Speed

3. Chapter 3: Permutations, Combinations, Probability & Modern Set Theory

- 3.1 Fundamental Counting Principles, Permutations & Circular Arrangements
- 3.2 Combinations, Distribution of Objects, Probability & Venn Diagrams

4. Chapter 4: Logical Deductive Reasoning: Syllogisms, Blood Relations, Direction Sense & Coding

- 4.1 Categorical Syllogisms & Venn-Euler Deduction Rules
- 4.2 Blood Relations, Direction Sense & Alphanumeric Coding-Decoding

5. Chapter 5: Analytical Reasoning: Seating Arrangements, Complex Puzzles, Clocks & Calendars

- 5.1 Linear, Circular & Matrix Seating Arrangements
- 5.2 Clocks, Angular Mechanics & Calendar Odd-Day Arithmetic

6. Chapter 6: Critical Reasoning & Reading Comprehension (Assumptions, Inferences, Corollaries & Crux)

- 6.1 Decoding UPSC CSAT Reading Comprehension Passages
- 6.2 Inferences, Corollaries, Logical Flaws & Extreme Modifier Filtering

7. Chapter 7: Data Interpretation, Quantitative Charts & Data Sufficiency (2-Statement & 3-Statement)

- 7.1 Tabular Data, Bar Graphs, Line Charts, Pie Charts & Caselets
- 7.2 Data Sufficiency Architecture (2-Statement and 3-Statement Formats)

8. Chapter 8: Decision Making, Interpersonal Skills, Visual Reasoning & CSAT Exam Strategy

- 8.1 Administrative Decision Making & Interpersonal Communication Skills
- 8.2 Non-Verbal / Visual Reasoning & 120-Minute CSAT Qualification Strategy

9. Solved Exam Practice Questions (MCQs)

10. Extended Comparative & Analytical Practice Set (Questions 36–75)

11. Rapid-Fire Last-Minute One-Liner Revision Capsule

Chapter 1: Number System, Divisibility, Remainder Theorems & Base System Arithmetic

Chapter Key Study Pillars — Chapter 1: Number System, Divisibility, Remainder Theorems & Base System Arithmetic

Key Study Pillar 1
Classification of Numbers, Prime Properties & Divisibility Frameworks

Key Study Pillar 2
Remainder Theorems, Cyclicity of Unit Digits & Trailing Zeros

1.1 Classification of Numbers, Prime Properties & Divisibility Frameworks

• **Natural, Whole, and Integer Sets:** Natural numbers start from 1, 2, 3 up to infinity, whereas whole numbers include zero alongside natural numbers, and integers span negative whole numbers, zero, and positive whole numbers as structured in foundational mathematics textbooks on the NCERT Textbook Portal.

• **Rational and Irrational Distinction:** A rational number is expressed in the ratio form `p / q` where `p` and `q` are integers and `q != 0`, having either a terminating decimal expansion or a non-terminating repeating decimal expansion; an irrational number exhibits a non-terminating and non-repeating decimal representation.

• **Prime Number Structural Rules:** Every prime number greater than 3 conforms to the linear expression `6k + 1` or `6k - 1` where `k` is a positive integer, though not every number of the form `6k + 1` or `6k - 1` is necessarily prime (for instance, 25 and 35 are composite).

• **Distribution of Primes:** Exactly 25 prime numbers exist between 1 and 100, and 21 prime numbers exist between 101 and 200, making 46 primes in total between 1 and 200, a frequent analytical question area in Civil Services Preliminary Paper-II conducted by the Union Public Service Commission.

• **Prime Factorization and Divisor Count:** If a composite positive integer `N` is prime-factorized as `N = (p^a) (q^b) (r^c)` where `p, q, r` are distinct prime numbers, then the total number of positive divisors (factors) of `N` is calculated by the formula `Total Factors = (a + 1) (b + 1) (c + 1)`.

• **Sum and Product of Divisors:** For `N = (p^a) (q^b) (r^c)`, the sum of all positive factors is given by `Sum = ((p^(a+1) - 1) / (p - 1)) ((q^(b+1) - 1) / (q - 1)) ((r^(c+1) - 1) / (r - 1))`, and the product of all factors is `Product = N^(Total Factors / 2)`.

1.2 Remainder Theorems, Cyclicity of Unit Digits & Trailing Zeros

• **Modular Remainder Multiplicative Rule:** The remainder of a product `(A B C)` divided by `D` equals the remainder of `(Rem(A/D) Rem(B/D) Rem(C/D))` divided by `D`, allowing large exponential expressions to be simplified step by step on the IUC Academy Portal.

• **Euler Totient and Fermat Little Theorem:** When `p` is a prime number and `a` is not divisible by `p`, the remainder of `a^(p - 1)` divided by `p` is always 1; more generally, for any two coprime positive integers `a` and `n`, `a^phi(n)` divided by `n` leaves a remainder of 1, where `phi(n) = n (1 - 1/p1) (1 - 1/p2)`.

• **Wilson Theorem for Factorials:** For any prime number `p`, the factorial expression `(p - 1)! + 1` is exactly divisible by `p`, which means `(p - 1)!` divided by `p` leaves a remainder of `p - 1` (or `-1`).

• **Unit Digit Cyclicity Rules:** Digits `0, 1, 5, 6` yield the exact same unit digit when raised to any positive integer power `n`; digits `4` and `9` follow a cycle of length 2 (`4^odd = 4, 4^even = 6; 9^odd = 9, 9^even = 1`); digits `2, 3, 7, 8` follow a cycle of length 4, where the exponent is divided by 4 to find the effective power.

• **Highest Power of a Prime in Factorial (Legendre Rule):** The highest power of a prime `p` dividing `n!` is `E_p(n!) = floor(n/p) + floor(n/p^2) + floor(n/p^3) + ...`, and the number of trailing zeros in `n!` is governed by `E_5(n!)` since prime factor 2 is always more abundant than 5.

1.3 Process Flowchart & Comparative Divisibility Matrix

Step-by-Step Conceptual Process Flowchart

STEP 1
Prime Factorize Number N = (p^a)(q^b)(r^c)

STEP 2
Apply Factor Formula or Modular Reduction

STEP 3
Evaluate Cyclicity or Totient Cycle

STEP 4
Verify Final Remainder or Digit Constraint

Divisibility Divisor	Operational Verification Rule	Algebraic Remainder Property	Typical UPSC CSAT Application
Divisor 3 and 9	Sum of all digits must be divisible by 3 or 9 respectively	Remainder of `N / 9` equals digital root of `N`	Missing digit identification in 6-digit numbers (UPSC Portal)
Divisor 4 and 8	Last 2 digits divisible by 4; last 3 digits divisible by 8	Remainder equals `Last 2 digits / 4` or `Last 3 digits / 8`	Finding valid rightmost digits in alphanumeric puzzles
Divisor 7, 11, 13	Difference between 3-digit triplets from right to left divisible by 7, 11, or 13	`1001 = 7 11 13` divides any 6-digit `abcabc` number	Evaluating 6-digit repeating block numbers `xyzxyz`
Divisor 11 Specific	Difference between sum of odd-place digits and even-place digits is 0 or multiple of 11	Alternating sign sum from right to left gives remainder	Palindromic number divisibility and digit swaps
Binomial `(a^n + b^n)`	Always divisible by `(a + b)` when exponent `n` is an odd positive integer	Never divisible by `(a - b)` for general positive integers	Remainder of `(17^23 + 29^23) / 46` equals 0

Did You Know?: Any six-digit number formed by repeating a three-digit number twice (such as `479479`) is always exactly divisible by 7, 11, 13, and 1001 because `abcabc = abc 1001 = abc 7 11 13`, as demonstrated in number theory modules on IUC Academy.

Exam Trap Alert: Candidates frequently assume that if a number is divisible by two numbers `a` and `b`, it is always divisible by `a b`. *This holds true only when* `a` *and* `b` *are coprime (*`HCF(a, b) = 1`*); in general, the number is guaranteed to be divisible by* `LCM(a, b)`*, not necessarily* `a` b (for example, 12 is divisible by 4 and 6, but not by 24).

★ **Memory Trick:** Remember the prime triplet `7 11 13 = 1001` as the "Thousand-and-One Arabian Nights Triplet" to solve any repeating three-digit block division problem in seconds.

Chapter 1 Comprehensive Analytical & Statutory Revision Matrix

Core Sub-Domain	Key Concept / Provision	Verified Analytical Parameters & Exam Distinctions (UPSC Official Portal)
Classification of Numbers, Prime Properties & Divisibility Frameworks	Natural, Whole, and Integer Sets	Natural numbers start from 1, 2, 3 up to infinity, whereas whole numbers include zero alongside natural numbers, and integers span negative whole numbers, zero, and positive whole numbers as structured in foundational mathematics textbooks on the NCERT Textbook Portal.
Remainder Theorems, Cyclicity of Unit Digits & Trailing Zeros	Rational and Irrational Distinction	A rational number is expressed in the ratio form `p / q` where `p` and `q` are integers and `q != 0`, having either a terminating decimal expansion or a non-terminating repeating decimal expansion; an irrational number exhibits a non-terminating and non-repeating decimal representation.
Process Flowchart & Comparative Divisibility Matrix	Prime Number Structural Rules	Every prime number greater than 3 conforms to the linear expression `6k + 1` or `6k - 1` where `k` is a positive integer, though not every number of the form `6k + 1` or `6k - 1` is necessarily prime (for instance, 25 and 35 are composite).
Classification of Numbers, Prime Properties & Divisibility Frameworks	Distribution of Primes	Exactly 25 prime numbers exist between 1 and 100, and 21 prime numbers exist between 101 and 200, making 46 primes in total between 1 and 200, a frequent analytical question area in Civil Services Preliminary Paper-II conducted by the Union Public Service Commission.
Remainder Theorems, Cyclicity of Unit Digits & Trailing Zeros	Prime Factorization and Divisor Count	If a composite positive integer `N` is prime-factorized as `N = (p^a) (q^b) (r^c)` where `p, q, r` are distinct prime numbers, then the total number of positive divisors (factors) of `N` is calculated by the formula `Total Factors = (a + 1) (b + 1) (c + 1)`.
Process Flowchart & Comparative Divisibility Matrix	Sum and Product of Divisors	For `N = (p^a) (q^b) (r^c)`, the sum of all positive factors is given by `Sum = ((p^(a+1) - 1) / (p - 1)) ((q^(b+1) - 1) / (q - 1)) ((r^(c+1) - 1) / (r - 1))`, and the product of all factors is `Product = N^(Total Factors / 2)`.
Classification of Numbers, Prime Properties & Divisibility Frameworks	Modular Remainder Multiplicative Rule	The remainder of a product `(A B C)` divided by `D` equals the remainder of `(Rem(A/D) Rem(B/D) Rem(C/D))` divided by `D`, allowing large exponential expressions to be simplified step by step on the IUC Academy Portal.
Remainder Theorems, Cyclicity of Unit Digits & Trailing Zeros	Euler Totient and Fermat Little Theorem	When `p` is a prime number and `a` is not divisible by `p`, the remainder of `a^(p - 1)` divided by `p` is always 1; more generally, for any two coprime positive integers `a` and `n`, `a^phi(n)` divided by `n` leaves a remainder of 1, where `phi(n) = n (1 - 1/p1) (1 - 1/p2)`.
Process Flowchart & Comparative Divisibility Matrix	Wilson Theorem for Factorials	For any prime number `p`, the factorial expression `(p - 1)! + 1` is exactly divisible by `p`, which means `(p - 1)!` divided by `p` leaves a remainder of `p - 1` (or `-1`).

Core Sub-Domain	Key Concept / Provision	Verified Analytical Parameters & Exam Distinctions (UPSC Official Portal)
Classification of Numbers, Prime Properties & Divisibility Frameworks	Unit Digit Cyclicity Rules	Digits `0, 1, 5, 6` yield the exact same unit digit when raised to any positive integer power `n`; digits `4` and `9` follow a cycle of length 2 (`4^odd = 4, 4^even = 6; 9^odd = 9, 9^even = 1`); digits `2, 3, 7, 8` follow a cycle of length 4, where the exponent is divided by 4 to find the effective power.
Remainder Theorems, Cyclicity of Unit Digits & Trailing Zeros	Highest Power of a Prime in Factorial (Legendre Rule)	The highest power of a prime `p` dividing `n!` is `E_p(n!) = floor(n/p) + floor(n/p^2) + floor(n/p^3) + ...`, and the number of trailing zeros in `n!` is governed by `E_5(n!)` since prime factor 2 is always more abundant than 5.

Chapter *1* Multi-Statement Exam Verification Drills

Chapter 1 Statement-Verification Drill #1 — Both Statements Verified Correct

Statement-I (Natural, Whole, and Integer Sets): Natural numbers start from 1, 2, 3 up to infinity, whereas whole numbers include zero alongside natural numbers, and integers span negative whole numbers, zero, and positive whole numbers as structured in foundational mathematics textbooks on the NCERT Textbook Portal.

Statement-II (Rational and Irrational Distinction): A rational number is expressed in the ratio form `p / q` where `p` and `q` are integers and `q != 0`, having either a terminating decimal expansion or a non-terminating repeating decimal expansion; an irrational number exhibits a non-terminating and non-repeating decimal representation.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 1 Statement-Verification Drill #2 — Both Statements Verified Correct

Statement-I (Prime Number Structural Rules): Every prime number greater than 3 conforms to the linear expression `6k + 1` or `6k - 1` where `k` is a positive integer, though not every number of the form `6k + 1` or `6k - 1` is necessarily prime (for instance, 25 and 35 are composite).

Statement-II (Distribution of Primes): Exactly 25 prime numbers exist between 1 and 100, and 21 prime numbers exist between 101 and 200, making 46 primes in total between 1 and 200, a frequent analytical question area in Civil Services Preliminary Paper-II conducted by the Union Public Service Commission.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 1 Statement-Verification Drill #3 — Both Statements Verified Correct

Statement-I (Prime Factorization and Divisor Count): If a composite positive integer `N` is prime-factorized as `N = (p^a) (q^b) (r^c)` where `p, q, r` are distinct prime numbers, then the total number of positive divisors (factors) of `N` is calculated by the formula `Total Factors = (a + 1) (b + 1) (c + 1)`.

Statement-II (Sum and Product of Divisors): For `N = (p^a) (q^b) (r^c)`, the sum of all positive factors is given by `Sum = ((p^(a+1) - 1) / (p - 1)) ((q^(b+1) - 1) / (q - 1)) ((r^(c+1) - 1) / (r - 1))`, and the product of all factors is `Product = N^(Total Factors / 2)`.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 1 Statement-Verification Drill #4 — Both Statements Verified Correct

Statement-I (Modular Remainder Multiplicative Rule): The remainder of a product `(A B C)` divided by `D` equals the remainder of `(Rem(A/D) Rem(B/D) Rem(C/D))` divided by `D`, allowing large exponential expressions to be simplified step by step on the IUC Academy Portal.

Statement-II (Euler Totient and Fermat Little Theorem): When `p` is a prime number and `a` is not divisible by `p`, the remainder of `a^(p - 1)` divided by `p` is always 1; more generally, for any two coprime positive integers `a` and `n`, `a^phi(n)` divided by `n` leaves a remainder of 1, where `phi(n) = n (1 - 1/p1) (1 - 1/p2)`.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 1 Statement-Verification Drill #5 — Both Statements Verified Correct

Statement-I (Wilson Theorem for Factorials): For any prime number `p`, the factorial expression `(p - 1)! + 1` is exactly divisible by `p`, which means `(p - 1)!` divided by `p` leaves a remainder of `p - 1` (or `-1`).

Statement-II (Unit Digit Cyclicity Rules): Digits `0, 1, 5, 6` yield the exact same unit digit when raised to any positive integer power `n`; digits `4` and `9` follow a cycle of length 2 (`4^odd = 4, 4^even = 6; 9^odd = 9, 9^even = 1`); digits `2, 3, 7, 8` follow a cycle of length 4, where the exponent is divided by 4 to find the effective power.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 2: Percentages, Profit-Loss, Interest, Ratios, Mixtures & Time-Work-Distance

Chapter Key Study Pillars — Chapter 2: Percentages, Profit-Loss, Interest, Ratios, Mixtures & Time-Work-Distance

Key Study Pillar 1
Percentage Equivalences, Successive Changes & Profit-Loss Mechanics

Key Study Pillar 2
Simple & Compound Interest, Alligation, Time-Work & Relative Speed

2.1 Percentage Equivalences, Successive Changes & Profit-Loss Mechanics

• **Fractional-Percentage Reciprocal Anchor:** Converting percentages into irreducible fractions eliminates decimal calculation errors (`12.5% = 1/8`, `14.28% = 1/7`, `16.66% = 1/6`, `37.5% = 3/8`, `62.5% = 5/8`, `83.33% = 5/6`) in competitive quantitative papers aligned with NCERT Textbooks.

• **Successive Percentage Change Formula:** When a value undergoes two successive percentage changes of `x%` and `y%`, the net percentage change is `Net Change (%) = x + y + (x * y) / 100`, where discounts or reductions carry a negative sign.

• **Product Constancy Principle (`Price *Consumption* = *Expenditure*`):** *If the price of a commodity increases by `r%` (or fraction `a / b`), the consumption must be reduced by `(r / (100 + r))`* 100% (or fraction `a / (a + b)`) to keep total expenditure unchanged.

• **Profit, Loss, and Markup Interrelation:** `Selling Price (SP) = Cost Price (CP) (1 + *Profit*%/100) = *Marked Price (MP)* (1 - Discount%/100)`, yielding the direct ratio `CP / MP = (100 - Discount%) / (100 + Profit%)` for merchant pricing problems on IUC Academy.

• **Dishonest Dealer Weight Adjustment:** When a trader claims to sell at cost price but uses a false weight `W_used` instead of true weight `W_true`, the actual profit percentage is `Profit (%) = ((W_true - W_used) / W_used) * 100`.

2.2 Simple & Compound Interest, Alligation, Time-Work & Relative Speed

• **Simple vs. Compound Interest Difference:** Under Simple Interest, `SI = (P R T) / 100`, whereas under Compound Interest compounded annually, `Amount = P (1 + R/100)^T`. *For 2 years,* `CI - SI = P` (R / 100)^2; for 3 years, `CI - SI = P (R / 100)^2 (3 + R / 100)`.

• **Rule of Alligation and Repeated Replacement:** When two ingredients at rates `C_1` (cheaper) and `C_2` (dearer) are mixed to yield a mean rate `C_m`, their quantity ratio is `Q_1 / Q_2 = (C_2 - C_m) / (C_m - C_1)`. If `x` liters are drawn from a vessel of `V` liters of pure liquid and replaced with water `n` times, the pure liquid left is `Final Pure Liquid = V * (1 - x / V)^n`.

• **LCM Efficiency Method for Time and Work:** If Worker A completes a job in `a` days and Worker B in `b` days, assign `Total Work = LCM(a, b)` units; then `Efficiency of A = Total Work / a` units/day and `Efficiency of B = Total Work / b` units/day, so combined time is `Total Work / (Eff_A + Eff_B)`.

• **Chain Rule of Work Equivalence:** For two work groups, `(M1 D1 H1 E1) / W1 = (M2 D2 H2 E2) / W2`, where `M` is manpower, `D` is days, `H` is hours per day, `E` is individual efficiency, and `W` is total work output.

• **Average Speed and Relative Velocity:** When equal distances are covered at speeds `u` and `v`, `Average Speed = (2 u v) / (u + v)` (harmonic mean). For two bodies moving with speeds `u` and `v`, `Relative Speed = u + v` in opposite directions and `Relative Speed = |u - v|` in the same direction.

2.3 Process Flowchart & Quantitative Formula Matrix

Step-by-Step Conceptual Process Flowchart



Quantitative Sub-Topic	Core Governing Equation	Invariant / Constant Quantity	High-Yield Application Context
Markup & Discount	`CP / MP = (100 - D%) / (100 + P%)`	Selling Price (`SP`) bridges `CP` and `MP`	Retail pricing questions in UPSC CSAT and SSC Exams
2-Year vs. 3-Year CI-SI Gap	`Gap_3yr / Gap_2yr = (300 + R) / 100`	Principal `P` and annual rate `R%`	Extracting interest rate directly from two-year and three-year gaps
Solution Concentration	`Initial_Vol Solute_1% = Final_Vol Solute_2%`	Mass of non-changing component (solute or solvent)	Evaporation or dilution of salt/acid solutions
Boats and Streams	`Speed_Boat = (Downstream + Upstream) / 2`	`Speed_Stream = (Downstream - Upstream) / 2`	River navigation against and along water current

Quantitative Sub-Topic	Core Governing Equation	Invariant / Constant Quantity	High-Yield Application Context
Trains & Platforms	`Time = (Length_Train + Length_Bridge) / Speed`	Convert `km/hr` to `m/s` by multiplying by `5 / 18`	Crossing poles, stationary platforms, or moving trains

Did You Know?: When two items are sold at the exact same Selling Price (`SP_1 = SP_2`), one at a profit of `x%` and the other at a loss of `x%`, the seller always incurs an overall net loss of `(x^2 / 100)%`, whereas if both items have the same Cost Price (`CP_1 = CP_2`), the net profit or loss is zero (NCERT Portal).

Exam Trap Alert: While converting speed from `km/hr` to `m/s`, candidates often multiply by `18 / 5` instead of `5 / 18`. Always verify that `1 km/hr = 1000 m / 3600 s = 5/18 m/s`, so the numerical value in `m/s` must be smaller than the numerical value in `km/hr`.

★ **Memory Trick:** Use **"D-U Half"** for Boats and Streams: Boat speed is half the sum `(D + U) / 2`, and Stream speed is half the difference `(D - U) / 2`.

Chapter *2* Comprehensive Analytical & Statutory Revision Matrix

Core Sub-Domain	Key Concept / Provision	Verified Analytical Parameters & Exam Distinctions (UPSC Official Portal)
Percentage Equivalences, Successive Changes & Profit-Loss Mechanics	Fractional-Percentage Reciprocal Anchor	Converting percentages into irreducible fractions eliminates decimal calculation errors (`12.5% = 1/8`, `14.28% = 1/7`, `16.66% = 1/6`, `37.5% = 3/8`, `62.5% = 5/8`, `83.33% = 5/6`) in competitive quantitative papers aligned with NCERT Textbooks.
Simple & Compound Interest, Alligation, Time-Work & Relative Speed	Successive Percentage Change Formula	When a value undergoes two successive percentage changes of `x%` and `y%`, the net percentage change is `Net Change (%) = x + y + (x * y) / 100`, where discounts or reductions carry a negative sign.
Process Flowchart & Quantitative Formula Matrix	Product Constancy Principle (`Price * Consumption = Expenditure`)	* *If the price of a commodity increases by* `r%` *(or fraction* `a / b`*), the consumption must be reduced by* `(r / (100 + r))`100% (or fraction `a / (a + b)`) to keep total expenditure unchanged.
Percentage Equivalences, Successive Changes & Profit-Loss Mechanics	Profit, Loss, and Markup Interrelation	`Selling Price (SP) = Cost Price (CP) (1 + Profit%/100) = Marked Price (MP) (1 - Discount%/100)`, yielding the direct ratio `CP / MP = (100 - Discount%) / (100 + Profit%)` for merchant pricing problems on IUC Academy.
Simple & Compound Interest, Alligation, Time-Work & Relative Speed	Dishonest Dealer Weight Adjustment	When a trader claims to sell at cost price but uses a false weight `W_used` instead of true weight `W_true`, the actual profit percentage is `Profit (%) = ((W_true - W_used) / W_used) * 100`.

Core Sub-Domain	Key Concept / Provision	Verified Analytical Parameters & Exam Distinctions (UPSC Official Portal)
Process Flowchart & Quantitative Formula Matrix	Simple vs. Compound Interest Difference	Under Simple Interest, `SI = (P R T) / 100`, whereas under Compound Interest compounded annually, `Amount = P (1 + R/100)^T`. *For 2 years,* `CI - SI = P` (R / 100)^2; for 3 years, `CI - SI = P (R / 100)^2 (3 + R / 100)`.
Percentage Equivalences, Successive Changes & Profit-Loss Mechanics	Rule of Alligation and Repeated Replacement	When two ingredients at rates `C_1` (cheaper) and `C_2` (dearer) are mixed to yield a mean rate `C_m`, their quantity ratio is `Q_1 / Q_2 = (C_2 - C_m) / (C_m - C_1)`. If `x` liters are drawn from a vessel of `V` liters of pure liquid and replaced with water `n` times, the pure liquid left is `Final Pure Liquid = V * (1 - x / V)^n`.
Simple & Compound Interest, Alligation, Time-Work & Relative Speed	LCM Efficiency Method for Time and Work	If Worker A completes a job in `a` days and Worker B in `b` days, assign `Total Work = LCM(a, b)` units; then `Efficiency of A = Total Work / a` units/day and `Efficiency of B = Total Work / b` units/day, so combined time is `Total Work / (Eff_A + Eff_B)`.
Process Flowchart & Quantitative Formula Matrix	Chain Rule of Work Equivalence	For two work groups, `(M1 D1 H1 E1) / W1 = (M2 D2 H2 E2) / W2`, where `M` is manpower, `D` is days, `H` is hours per day, `E` is individual efficiency, and `W` is total work output.
Percentage Equivalences, Successive Changes & Profit-Loss Mechanics	Average Speed and Relative Velocity	When equal distances are covered at speeds `u` and `v`, `Average Speed = (2 u v) / (u + v)` (harmonic mean). For two bodies moving with speeds `u` and `v`, `Relative Speed = u + v` in opposite directions and `Relative Speed = |u - v|` in the same direction.

Chapter 2 Multi-Statement Exam Verification Drills

Chapter 2 Statement-Verification Drill #1 — Both Statements Verified Correct

Statement-I (Fractional-Percentage Reciprocal Anchor): Converting percentages into irreducible fractions eliminates decimal calculation errors (`12.5% = 1/8`, `14.28% = 1/7`, `16.66% = 1/6`, `37.5% = 3/8`, `62.5% = 5/8`, `83.33% = 5/6`) in competitive quantitative papers aligned with NCERT Textbooks.

Statement-II (Successive Percentage Change Formula): When a value undergoes two successive percentage changes of `x%` and `y%`, the net percentage change is `Net Change (%) = x + y + (x * y) / 100`, where discounts or reductions carry a negative sign.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 2 Statement-Verification Drill #2 — Both Statements Verified Correct

Statement-I (Product Constancy Principle (`Price * Consumption = Expenditure`)): * *If the price of a commodity increases by* `r%` (*or fraction* `a / b`), *the consumption must be reduced by* `(r / (100 + r))`100% (or fraction `a / (a + b)`) to keep total expenditure unchanged.

Statement-II (Profit, Loss, and Markup Interrelation): `Selling Price (SP) = Cost Price (CP) (1 + Profit%/100) = Marked Price (MP) (1 - Discount%/100)`, yielding the direct ratio `CP / MP = (100 - Discount%) / (100 + Profit%)` for merchant pricing problems on IUC Academy.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 2 Statement-Verification Drill #3 — Both Statements Verified Correct

Statement-I (Dishonest Dealer Weight Adjustment): When a trader claims to sell at cost price but uses a false weight `W_used` instead of true weight `W_true`, the actual profit percentage is `Profit (%) = ((W_true - W_used) / W_used) * 100`.

Statement-II (Simple vs. Compound Interest Difference): Under Simple Interest, `SI = (P R T) / 100`, whereas under Compound Interest compounded annually, `Amount = P (1 + R/100)^T`. *For 2 years,* `CI - SI = P` (R / 100)^2; for 3 years, `CI - SI = P (R / 100)^2 (3 + R / 100)`.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 2 Statement-Verification Drill #4 — Both Statements Verified Correct

Statement-I (Rule of Alligation and Repeated Replacement): When two ingredients at rates `C_1` (cheaper) and `C_2` (dearer) are mixed to yield a mean rate `C_m`, their quantity ratio is `Q_1 / Q_2 = (C_2 - C_m) / (C_m - C_1)`. If `x` liters are drawn from a vessel of `V` liters of pure liquid and replaced with water `n` times, the pure liquid left is `Final Pure Liquid = V * (1 - x / V)^n`.

Statement-II (LCM Efficiency Method for Time and Work): If Worker A completes a job in `a` days and Worker B in `b` days, assign `Total Work = LCM(a, b)` units; then `Efficiency of A = Total Work / a` units/day and `Efficiency of B = Total Work / b` units/day, so combined time is `Total Work / (Eff_A + Eff_B)`.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 2 Statement-Verification Drill #5 — Both Statements Verified Correct

Statement-I (Chain Rule of Work Equivalence): For two work groups, `(M1 D1 H1 E1) / W1 = (M2 D2 H2 E2) / W2`, where `M` is manpower, `D` is days, `H` is hours per day, `E` is individual efficiency, and `W` is total work output.

Statement-II (Average Speed and Relative Velocity): When equal distances are covered at speeds `u` and `v`, `Average Speed = (2 u v) / (u + v)` (harmonic mean). For two bodies moving with speeds `u` and `v`, `Relative Speed = u + v` in opposite directions and `Relative Speed = |u - v|` in the same direction.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 3: Permutations, Combinations, Probability & Modern Set Theory

Chapter Key Study Pillars — Chapter 3: Permutations, Combinations, Probability & Modern Set Theory

Key Study Pillar 1
Fundamental Counting Principles, Permutations & Circular Arrangements

Key Study Pillar 2
Combinations, Distribution of Objects, Probability & Venn Diagrams

3.1 Fundamental Counting Principles, Permutations & Circular Arrangements

• **Addition vs. Multiplication Rule of Counting:** If Task A can be done in `m` ways and Task B can be done independently in `n` ways, then performing "Task A OR Task B" (mutually exclusive events) occurs in `m + n` ways, while performing "Task A AND Task B" (sequential stages) occurs in `m * n` ways (NCERT Textbooks).

• **Linear Permutation Formula:** The number of ordered arrangements of `r` objects selected from `n` distinct objects is `nPr = n! / (n - r)!`. When all `n` objects are arranged in a row, the total arrangements equal `n!`.

• **Permutations with Identical Objects:** If a set of `n` objects contains `p` identical objects of one kind, `q` identical objects of a second kind, and `r` identical objects of a third kind, the number of distinct linear permutations is `n! / (p! q! r!)`.

• **String Method (Together) vs. Gap Method (Never Together):** To keep `k` specific items together in a group of `n` items, treat the `k` items as 1 single unit and arrange `(n - k + 1)` units along with internal arrangements `k!`, giving `(n - k + 1)! k!`. *To keep* `k` *items never together, arrange the remaining* `(n - k)` *items first creating* `(n - k + 1)` *gaps, then place the* `k` *items in those gaps in* `(n - k)!` C(n - k + 1, k) * k! ways.

• **Circular Permutations:** The number of circular arrangements of `n` distinct persons seated at a circular table where clockwise and anticlockwise orders are distinct is `(n - 1)!`; for necklaces or garlands where clockwise and anticlockwise orders are indistinguishable, the formula is `(n - 1)! / 2`.

3.2 Combinations, Distribution of Objects, Probability & Venn Diagrams

• **Combination Selection Rule:** The number of ways of selecting `r` objects from `n` distinct objects where order does not matter is `nCr = n! / (r! * (n - r)!)`, satisfying symmetry `nCr = nC(n - r)` and Pascal's identity `nCr + nC(r - 1) = (n + 1)Cr` (UPSC Portal).

• **Beggar's Method (Identical Objects into Distinct Boxes):** The number of ways of distributing `n` identical objects among `r` distinct recipients such that each recipient gets zero or more objects is `C(n + r - 1, r - 1)`; if each recipient must receive at least 1 object, the count is `C(n - 1, r - 1)`.

• **Derangement Formula (Dearrangement of Letters):** The number of ways in which `n` numbered letters can be placed into `n` addressed envelopes such that no letter goes into its right envelope is `D(n) = n! * (1 - 1/1! + 1/2! - 1/3! + ... + (-1)^n / n!)`, which gives `D(1) = 0, D(2) = 1, D(3) = 2, D(4) = 9, D(5) = 44`.

• **Classical, Conditional, and Binomial Probability:** Classical probability is `P(E) = Favorable Outcomes / Total Outcomes`. For two events `A` and `B`, `P(A or B) = P(A) + P(B) - P(A and B)`.
For independent events, `P(A and B) = P(A) * P(B)`, and `P(At least one success) = 1 - P(No success)`.

• **Two-Set and Three-Set Principle of Inclusion-Exclusion:** For three finite sets `A, B, C`, the union cardinality is `n(A U B U C) = n(A) + n(B) + n(C) - n(A int B) - n(B int C) - n(C int A) + n(A int B int C)`.

3.3 Process Flowchart & Combinatorics Comparison Table

Step-by-Step Conceptual Process Flowchart

STEP 1
Check Whether Order Matters (Permutation vs Combination)

STEP 2
Identify Identical vs Distinct Elements

STEP 3
Apply String, Gap, or Inclusion-Exclusion Rule

STEP 4
Compute Ratio for Probability if Required

Combinatorial Scenario	Order / Distinctness Condition	Exact Mathematical Formula	Benchmark Numerical Value / Case		
Non-Empty Subsets	Selection of 1 or more items from `n` distinct items	`(2^n) - 1`	For `n = 5` items, `(2^5) - 1 = 31` ways		
Handshakes / Chess Games	Every pair of `n` persons interacts once	`nC2 = n * (n - 1) / 2`	10 players play `10 * 9 / 2 = 45` matches		
Diagonals of Polygon	Joining non-adjacent vertices of an `n`-sided polygon	`nC2 - n = n * (n - 3) / 2`	Octagon (`n = 8`) has `8 * 5 / 2 = 20` diagonals		
Derangement `D(n)`	Zero items placed in their original assigned positions	`n! * sum((-1)^k / k!)`	`D(3) = 2`, `D(4) = 9`, `D(5) = 44` (IUC Academy)		
Bayes Conditional Law	Posterior probability of cause `A_i` given event `B`	`P(A_i | B) = (P(A_i) * P(B | A_i)) / P(B)`	Defective item inspection across 3 factory machines		

Did You Know?: In UPSC CSAT 2021–2025 papers published on the UPSC Official Portal, combinatorics and number puzzles together accounted for nearly 35% of all mathematics questions, testing case-by-case enumeration alongside `nCr` formulas.

Exam Trap Alert: Never subtract `(Total Arrangements - Together Arrangements)` to find the number of ways in which **3 or more** items are "never together". Subtracting "all 3 together" still leaves cases where 2 of them are together; you must strictly use the **Gap Method** when 3 or more items cannot be adjacent.

★ **Memory Trick:** Memorize Derangement numbers `D(1)` to `D(5)` as the sequence **"0 - 1 - 2 - 9 - 44"** so you never have to expand the alternating factorial series in the exam hall.

Chapter 3 Comprehensive Analytical & Statutory Revision Matrix

Core Sub-Domain	Key Concept / Provision	Verified Analytical Parameters & Exam Distinctions (UPSC Official Portal)
Fundamental Counting Principles, Permutations & Circular Arrangements	**Addition vs. Multiplication Rule of Counting**	If Task A can be done in `m` ways and Task B can be done independently in `n` ways, then performing "Task A OR Task B" (mutually exclusive events) occurs in `m + n` ways, while performing "Task A AND Task B" (sequential stages) occurs in `m * n` ways (NCERT Textbooks).
Combinations, Distribution of Objects, Probability & Venn Diagrams	**Linear Permutation Formula**	The number of ordered arrangements of `r` objects selected from `n` distinct objects is `nPr = n! / (n - r)!`. When all `n` objects are arranged in a row, the total arrangements equal `n!`.

Core Sub-Domain	Key Concept / Provision	Verified Analytical Parameters & Exam Distinctions (UPSC Official Portal)
Process Flowchart & Combinatorics Comparison Table	**Permutations with Identical Objects**	If a set of **n** objects contains **p** identical objects of one kind, **q** identical objects of a second kind, and **r** identical objects of a third kind, the number of distinct linear permutations is **n! / (p! q! r!)**.
Fundamental Counting Principles, Permutations & Circular Arrangements	**String Method (Together) vs. Gap Method (Never Together)**	To keep **k** specific items together in a group of **n** items, treat the **k** items as 1 single unit and arrange **(n - k + 1)** units along with internal arrangements **k!**, giving **(n - k + 1)! k!**. *To keep* **k** *items never together, arrange the remaining* **(n - k)** *items first creating* **(n - k + 1)** *gaps, then place the* **k** *items in those gaps in* **(n - k)!** C(n - k + 1, k) * k! ways.
Combinations, Distribution of Objects, Probability & Venn Diagrams	**Circular Permutations**	The number of circular arrangements of **n** distinct persons seated at a circular table where clockwise and anticlockwise orders are distinct is **(n - 1)!**; for necklaces or garlands where clockwise and anticlockwise orders are indistinguishable, the formula is **(n - 1)! / 2**.
Process Flowchart & Combinatorics Comparison Table	**Combination Selection Rule**	The number of ways of selecting **r** objects from **n** distinct objects where order does not matter is **nCr = n! / (r! * (n - r)!)**, satisfying symmetry **nCr = nC(n - r)** and Pascal's identity **nCr + nC(r - 1) = (n + 1)Cr** (UPSC Portal).
Fundamental Counting Principles, Permutations & Circular Arrangements	**Beggar's Method (Identical Objects into Distinct Boxes)**	The number of ways of distributing **n** identical objects among **r** distinct recipients such that each recipient gets zero or more objects is **C(n + r - 1, r - 1)**; if each recipient must receive at least 1 object, the count is **C(n - 1, r - 1)**.
Combinations, Distribution of Objects, Probability & Venn Diagrams	**Derangement Formula (Dearrangement of Letters)**	The number of ways in which **n** numbered letters can be placed into **n** addressed envelopes such that no letter goes into its right envelope is **D(n) = n! * (1 - 1/1! + 1/2! - 1/3! + ... + (-1)^n / n!)**, which gives **D(1) = 0, D(2) = 1, D(3) = 2, D(4) = 9, D(5) = 44**.
Process Flowchart & Combinatorics Comparison Table	**Classical, Conditional, and Binomial Probability**	Classical probability is **P(E) = Favorable Outcomes / Total Outcomes**. For two events **A** and **B**, **P(A or B) = P(A) + P(B) - P(A and B)**. For independent events, **P(A and B) = P(A) * P(B)**, and **P(At least one success) = 1 - P(No success)**.
Fundamental Counting Principles, Permutations & Circular Arrangements	**Two-Set and Three-Set Principle of Inclusion-Exclusion**	For three finite sets **A, B, C**, the union cardinality is **n(A U B U C) = n(A) + n(B) + n(C) - n(A int B) - n(B int C) - n(C int A) + n(A int B int C)**.

Chapter 3 Multi-Statement Exam Verification Drills

Chapter 3 Statement-Verification Drill #1 — Both Statements Verified Correct

Statement-I (Addition vs. Multiplication Rule of Counting): If Task A can be done in `m` ways and Task B can be done independently in `n` ways, then performing "Task A OR Task B" (mutually exclusive events) occurs in `m + n` ways, while performing "Task A AND Task B" (sequential stages) occurs in `m * n` ways (NCERT Textbooks).

Statement-II (Linear Permutation Formula): The number of ordered arrangements of `r` objects selected from `n` distinct objects is `nPr = n! / (n - r)!`. When all `n` objects are arranged in a row, the total arrangements equal `n!`.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 3 Statement-Verification Drill #2 — Both Statements Verified Correct

Statement-I (Permutations with Identical Objects): If a set of `n` objects contains `p` identical objects of one kind, `q` identical objects of a second kind, and `r` identical objects of a third kind, the number of distinct linear permutations is `n! / (p! q! r!)`.

Statement-II (String Method (Together) vs. Gap Method (Never Together)): To keep `k` specific items together in a group of `n` items, treat the `k` items as 1 single unit and arrange `(n - k + 1)` units along with internal arrangements `k!`, giving `(n - k + 1)! k!`. *To keep* `k` *items never together, arrange the remaining* `(n - k)` *items first creating* `(n - k + 1)` *gaps, then place the* `k` *items in those gaps in* `(n - k)!` C(n - k + 1, k) * k! ways.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 3 Statement-Verification Drill #3 — Both Statements Verified Correct

Statement-I (Circular Permutations): The number of circular arrangements of `n` distinct persons seated at a circular table where clockwise and anticlockwise orders are distinct is `(n - 1)!`; for necklaces or garlands where clockwise and anticlockwise orders are indistinguishable, the formula is `(n - 1)! / 2`.

Statement-II (Combination Selection Rule): The number of ways of selecting `r` objects from `n` distinct objects where order does not matter is `nCr = n! / (r! * (n - r)!)`, satisfying symmetry `nCr = nC(n - r)` and Pascal's identity `nCr + nC(r - 1) = (n + 1)Cr` (UPSC Portal).

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 3 Statement-Verification Drill #4 — Both Statements Verified Correct

Statement-I (Beggar's Method (Identical Objects into Distinct Boxes)): The number of ways of distributing `n` identical objects among `r` distinct recipients such that each recipient gets zero or more objects is `C(n + r - 1, r - 1)`; if each recipient must receive at least 1 object, the count is `C(n - 1, r - 1)`.

Statement-II (Derangement Formula (Dearrangement of Letters)): The number of ways in which `n` numbered letters can be placed into `n` addressed envelopes such that no letter goes into its right envelope is `D(n) = n! * (1 - 1/1! + 1/2! - 1/3! + ... + (-1)^n / n!)`, which gives `D(1) = 0, D(2) = 1, D(3) = 2, D(4) = 9, D(5) = 44`.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 3 Statement-Verification Drill #5 — Both Statements Verified Correct

Statement-I (Classical, Conditional, and Binomial Probability): Classical probability is `P(E) = Favorable Outcomes / Total Outcomes`. For two events `A` and `B`, `P(A or B) = P(A) + P(B) - P(A and B)`. For independent events, `P(A and B) = P(A) * P(B)`, and `P(At least one success) = 1 - P(No success)`.

Statement-II (Two-Set and Three-Set Principle of Inclusion-Exclusion): For three finite sets `A, B, C`, the union cardinality is `n(A U B U C) = n(A) + n(B) + n(C) - n(A int B) - n(B int C) - n(C int A) + n(A int B int C)`.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 4: Logical Deductive Reasoning: Syllogisms, Blood Relations, Direction Sense & Coding

Chapter Key Study Pillars — Chapter 4: Logical Deductive Reasoning: Syllogisms, Blood Relations, Direction Sense & Coding

Key Study Pillar 1
Categorical Syllogisms & Venn-Euler Deduction Rules

Key Study Pillar 2
Blood Relations, Direction Sense & Alphanumeric Coding-Decoding

4.1 Categorical Syllogisms & Venn-Euler Deduction Rules

• **Four Standard Categorical Propositions:** Universal Affirmative (`All A are B`), Universal Negative (`No A is B`), Particular Affirmative (`Some A are B`), and Particular Negative (`Some A are not B`) form the foundation of deductive logic tested by UPSC and SSC.

• **Definite Conclusion vs. Possibility Conclusion:** A definite conclusion (`Some A are C`) must hold true in **every single valid Venn diagram** drawn from the statements; if it fails in even one valid diagram, the definite conclusion is false. Conversely, a possibility conclusion (`All A being C is a possibility`) is true if it holds in **at least one** valid diagram without violating any given statement.

• **Complementary Pair ("Either-Or") Conditions:** Two individually false conclusions form a valid `"Either I or II follows"` pair if and only if: (1) both conclusions share the exact same subject and predicate terms, (2) both are individually indefinite/false, and (3) one is affirmative while the other is negative (`Some A are B` + `No A is B`, or `Some A are B` + `Some A are not B`, or `All A are B` + `Some A are not B`).

• **"Only a few" and "Only" Statements:** `"Only a few A are B"` translates simultaneously to `Some A are B` AND `Some A are not B`. By contrast, `"Only A are B"` reverses the subject-predicate order to mean `All B are A` with the exclusive restriction that `B` cannot intersect with anything outside `A` (IUC Academy).

4.2 Blood Relations, Direction Sense & Alphanumeric Coding-Decoding

• **Generation Tree Notation for Blood Relations:** Use vertical lines for parent-child transitions (`+1` generation for parents/uncles/aunts, `0` generation for siblings/cousins/spouses, `-1` generation for children/nephews/nieces), `[+]` for male, `[-]` for female, `[=]` for married couple, and `[-]` horizontal line for siblings.

• **Coded Blood Relation Backward-Scan Technique:** When relationships are coded with symbols such as `A + B means A is the father of B`, evaluate gender eligibility from the right end of the expression before drawing full family trees to eliminate impossible options rapidly.

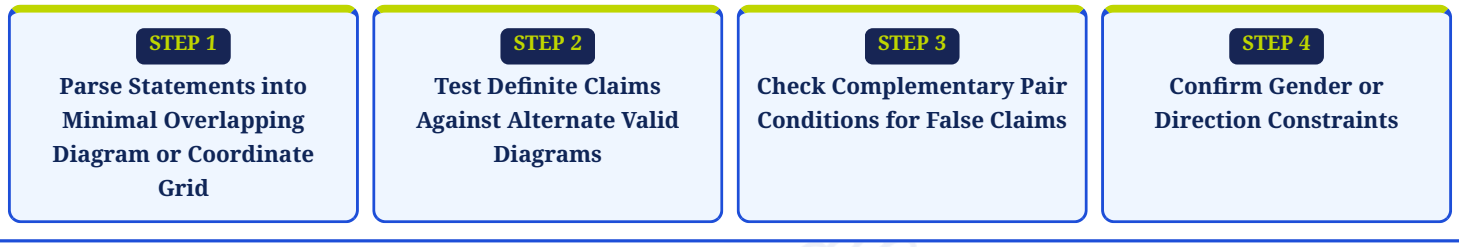
• **Direction Sense and Pythagoras Displacement:** Track net North-South displacement (`Delta_Y = North - South`) and net East-West displacement (`Delta_X = East - West`) independently; the shortest straight-line distance from the origin is `Distance = sqrt((Delta_X)^2 + (Delta_Y)^2)`.

• **Shadow and Angular Rotation Rules:** At Sunrise (East sun), all shadows fall toward the **West** (left of a person facing North, right of a person facing South); at Sunset (West sun), all shadows fall toward the **East**; at 12:00 Noon, no shadow is formed.

• **Alphanumeric Position and Opposite Letter Pairs:** Memorize standard alphabetical indices (`A = 1` to `Z = 26`) via **EJOTY** (`5, 10, 15, 20, 25`) and **CFILORUX** (`3, 6, 9, 12, 15, 18, 21, 24`), along with opposite letter pairs whose positions sum to 27 (`A + Z = 27`, `B + Y = 27`, `C + X = 27`).

4.3 Process Flowchart & Deductive Logic Matrix

Step-by-Step Conceptual Process Flowchart



Deductive Sub-Topic	Core Analytical Rule	Common Distractor / Pitfall	Verification Shortcut
Syllogism (`All + Some`)	`All A are B` implies `Some A are B` and `Some B are A`	Concluding `All B are A` from `All A are B`	Draw concentric circles (`A` inside `B`)
Syllogism (`Some not`)	`Some A are not B` does **not** imply `Some B are not A`	Reversing `Some A are not B` to `Some B are not A`	Test whether `All B` can fit inside `A`
Blood Relations	Never infer gender from a person's name (`Kiran`, `Kamal`, `Suman`)	Assuming gender without an explicit relation keyword	Check symbol definition for the final variable
Direction Shadows	Morning shadow = West; Evening shadow = East	Confusing left/right when person faces South	Facing South: West is Right, East is Left
Letter Coding	Sum of opposite alphabetical ranks is always `27`	Counting backward manually from `Z`	Subtract forward rank from `27` (`27 - R`)

Did You Know?: In formal Aristotelian and Venn logic used in UPSC CSAT, the statement `"All A are B"` always guarantees the particular statement `"Some A are B"` (assuming non-empty sets), whereas in everyday conversation people mistakenly treat `"Some"` as meaning `"Some but not all"`.

Exam Trap Alert: In `"All A are B"` + `"All B are C"`, the pair of conclusions `"All C are A"` and `"Some C are not A"` IS a valid complementary (`Either-Or`) pair, whereas `"All A are B"` + `"No A is B"` is **NOT** a complementary pair because both can be false simultaneously when only some `A` are `B`.

★ **Memory Trick:** Remember opposite alphabet pairs using mnemonic words: **AZ**ad, **B**o**Y**, **C**ra**X**, **D**e**W**, **EV**ening, **FU**ll, **GT** Road, **H**igh **S**chool, **I**ndian **R**ailway, **J**ack **Q**ueen, **KP** Thakur, **L**o**V**e, **M**a**N**.

Chapter *4* Comprehensive Analytical & Statutory Revision Matrix

Core Sub-Domain	Key Concept / Provision	Verified Analytical Parameters & Exam Distinctions (UPSC Official Portal)
Categorical Syllogisms & Venn-Euler Deduction Rules	**Four Standard Categorical Propositions**	Universal Affirmative (`All A are B`), Universal Negative (`No A is B`), Particular Affirmative (`Some A are B`), and Particular Negative (`Some A are not B`) form the foundation of deductive logic tested by UPSC and SSC.
Blood Relations, Direction Sense & Alphanumeric Coding-Decoding	**Definite Conclusion vs. Possibility Conclusion**	A definite conclusion (`Some A are C`) must hold true in **every single valid Venn diagram** drawn from the statements; if it fails in even one valid diagram, the definite conclusion is false. Conversely, a possibility conclusion (`All A being C is a possibility`) is true if it holds in **at least one** valid diagram without violating any given statement.
Process Flowchart & Deductive Logic Matrix	**Complementary Pair ("Either-Or") Conditions**	Two individually false conclusions form a valid `"Either I or II follows"` pair if and only if: (1) both conclusions share the exact same subject and predicate terms, (2) both are individually indefinite/false, and (3) one is affirmative while the other is negative (`Some A are B` + `No A is B`, or `Some A are B` + `Some A are not B`, or `All A are B` + `Some A are not B`).
Categorical Syllogisms & Venn-Euler Deduction Rules	**"Only a few" and "Only" Statements**	`"Only a few A are B"` translates simultaneously to `Some A are B` AND `Some A are not B`. By contrast, `"Only A are B"` reverses the subject-predicate order to mean `All B are A` with the exclusive restriction that `B` cannot intersect with anything outside `A` (IUC Academy).
Blood Relations, Direction Sense & Alphanumeric Coding-Decoding	**Generation Tree Notation for Blood Relations**	Use vertical lines for parent-child transitions (`+1` generation for parents/uncles/aunts, `0` generation for siblings/cousins/spouses, `-1` generation for children/nephews/nieces), `[+]` for male, `[-]` for female, `[=]` for married couple, and `[-]` horizontal line for siblings.
Process Flowchart & Deductive Logic Matrix	**Coded Blood Relation Backward-Scan Technique**	When relationships are coded with symbols such as `A + B means A is the father of B`, evaluate gender eligibility from the right end of the expression before drawing full family trees to eliminate impossible options rapidly.
Categorical Syllogisms & Venn-Euler Deduction Rules	**Direction Sense and Pythagoras Displacement**	Track net North-South displacement (`Delta_Y = North - South`) and net East-West displacement (`Delta_X = East - West`) independently; the shortest straight-line distance from the origin is `Distance = sqrt((Delta_X)^2 + (Delta_Y)^2)`.

Core Sub-Domain	Key Concept / Provision	Verified Analytical Parameters & Exam Distinctions (UPSC Official Portal)
Blood Relations, Direction Sense & Alphanumeric Coding-Decoding	**Shadow and Angular Rotation Rules**	At Sunrise (East sun), all shadows fall toward the **West** (left of a person facing North, right of a person facing South); at Sunset (West sun), all shadows fall toward the **East**; at 12:00 Noon, no shadow is formed.
Process Flowchart & Deductive Logic Matrix	**Alphanumeric Position and Opposite Letter Pairs**	Memorize standard alphabetical indices (`A = 1` to `Z = 26`) via **EJOTY** (`5, 10, 15, 20, 25`) and **CFILORUX** (`3, 6, 9, 12, 15, 18, 21, 24`), along with opposite letter pairs whose positions sum to 27 (`A + Z = 27`, `B + Y = 27`, `C + X = 27`).

Chapter 4 Multi-Statement Exam Verification Drills

Chapter 4 Statement-Verification Drill #1 — Both Statements Verified Correct

Statement-I (Four Standard Categorical Propositions): Universal Affirmative (`All A are B`), Universal Negative (`No A is B`), Particular Affirmative (`Some A are B`), and Particular Negative (`Some A are not B`) form the foundation of deductive logic tested by UPSC and SSC.

Statement-II (Definite Conclusion vs. Possibility Conclusion): A definite conclusion (`Some A are C`) must hold true in **every single valid Venn diagram** drawn from the statements; if it fails in even one valid diagram, the definite conclusion is false. Conversely, a possibility conclusion (`All A being C is a possibility`) is true if it holds in **at least one** valid diagram without violating any given statement.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 4 Statement-Verification Drill #2 — Both Statements Verified Correct

Statement-I (Complementary Pair ("Either-Or") Conditions): Two individually false conclusions form a valid `"Either I or II follows"` pair if and only if: (1) both conclusions share the exact same subject and predicate terms, (2) both are individually indefinite/false, and (3) one is affirmative while the other is negative (`Some A are B` + `No A is B`, or `Some A are B` + `Some A are not B`, or `All A are B` + `Some A are not B`).

Statement-II ("Only a few" and "Only" Statements): `"Only a few A are B"` translates simultaneously to `Some A are B` AND `Some A are not B`. By contrast, `"Only A are B"` reverses the subject-predicate order to mean `All B are A` with the exclusive restriction that `B` cannot intersect with anything outside `A` (IUC Academy).

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 4 Statement-Verification Drill #3 — Both Statements Verified Correct

Statement-I (Generation Tree Notation for Blood Relations): Use vertical lines for parent-child transitions (`+1` generation for parents/uncles/aunts, `0` generation for siblings/cousins/spouses, `-1` generation for children/nephews/nieces), `[+]` for male, `[-]` for female, `[=]` for married couple, and `[-]` horizontal line for siblings.

Statement-II (Coded Blood Relation Backward-Scan Technique): When relationships are coded with symbols such as `A + B means A is the father of B`, evaluate gender eligibility from the right end of the expression before drawing full family trees to eliminate impossible options rapidly.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 4 Statement-Verification Drill #4 — Both Statements Verified Correct

Statement-I (Direction Sense and Pythagoras Displacement): Track net North-South displacement (`Delta_Y = North - South`) and net East-West displacement (`Delta_X = East - West`) independently; the shortest straight-line distance from the origin is `Distance = sqrt((Delta_X)^2 + (Delta_Y)^2)`.

Statement-II (Shadow and Angular Rotation Rules): At Sunrise (East sun), all shadows fall toward the **West** (left of a person facing North, right of a person facing South); at Sunset (West sun), all shadows fall toward the **East**; at 12:00 Noon, no shadow is formed.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 5: Analytical Reasoning: Seating Arrangements, Complex Puzzles, Clocks & Calendars

Chapter Key Study Pillars — Chapter 5: Analytical Reasoning: Seating Arrangements, Complex Puzzles, Clocks & Calendars

Key Study Pillar 1
Linear, Circular & Matrix Seating Arrangements

Key Study Pillar 2
Clocks, Angular Mechanics & Calendar Odd-Day Arithmetic

5.1 Linear, Circular & Matrix Seating Arrangements

• **Linear Row Orientation Rules:** When `n` people sit in a single row facing **North**, moving right corresponds to moving East and moving left corresponds to moving West; when facing **South**, left and right directions reverse completely. In dual-row arrangements where Row 1 faces South and Row 2 faces North, persons sitting opposite each other have diagonally opposite left/right hands (IUC Academy).

• **Circular and Polygon Seating:** When everyone at a circular table faces the **Center**, moving **Clockwise** means moving to the **Left**, and moving **Anticlockwise** means moving to the **Right**; when facing **Outward** (away from center), Clockwise is Right and Anticlockwise is Left.

• **Conjunction vs. Relative Pronoun Grammar in Puzzles:** In seating statements like `"A sits third to the left of B, who sits second to the right of C"`, the relative pronoun (`who`, `whom`, `whose`, `which`) always refers to the **immediately preceding noun** (`B`). Conversely, conjunctions (`and`, `but`, `while`, `whereas`) always refer to the **first subject** of the clause (`A`).

• **Multi-Variable Floor, Box, and Scheduling Puzzles:** Anchor fixed parameters (such as Floor numbers `8` down to `1`, or Days `Monday` to `Sunday`) in the leftmost column of a tabular grid, record definite placements directly inside the table, and note negative constraints (`X != Floor 4`) beside the corresponding row.

5.2 Clocks, Angular Mechanics & Calendar Odd-Day Arithmetic

• **Clock Hand Angular Speeds:** The Minute Hand completes `360 degrees` in 60 minutes, moving at `6 degrees per minute`; the Hour Hand completes `360 degrees` in 12 hours (720 minutes), moving at `0.5 degrees per minute`. Therefore, the **Relative Angular Speed** of the minute hand over the hour hand is `6 - 0.5 = 5.5 degrees per minute` (`11/2 degrees/min`).

• **Exact Angle Formula at `H` Hours and `M` Minutes:** The angle `Theta` between the hour hand and minute hand at `H:M` is `Theta = |30 H - (11 / 2) M|` degrees. If `Theta > 180`, the reflex/smaller interior angle is `360 - Theta`.

• **Coincidence, Opposite, and Right-Angle Frequencies:** The hands of a clock coincide (`0 degrees`) **11 times in 12 hours** and **22 times in 24 hours** (missing once between 11 and 1 o'clock); they are opposite (`180 degrees`) **11 times in 12 hours** and **22 times in 24 hours** (missing once between 5 and 7 o'clock); they are at right angles (`90 degrees`) **22 times in 12 hours** and **44 times in 24 hours**.

• **Calendar Leap Year and Odd-Day System:** An ordinary year has `365 days = 52 weeks + 1 odd day`; a leap year has `366 days = 52 weeks + 2 odd days`. A non-century year is a leap year if divisible by 4; a century year (`1600, 1700, 1800, 1900, 2000`) is a leap year **only if divisible by 400** (UPSC Portal).

• **Century Odd-Day Benchmarks:** `100 years` contain 76 ordinary + 24 leap years = `124 odd days ≡ 5 odd days (mod 7)`; `200 years ≡ 3 odd days`; `300 years ≡ 1 odd day`; `400 years ≡ (4 * 5 + 1) = 21 ≡ 0 odd days`.

5.3 Process Flowchart & Clock-Calendar Reference Table

Step-by-Step Conceptual Process Flowchart

STEP 1 — **Identify Anchor Variable (Fixed Floor/Day or Reference Year)**

STEP 2 — **Convert Relative Clues or Odd Days into Modular Equivalents**

STEP 3 — **Eliminate Contradictory Branches Using Negative Clues**

STEP 4 — **Compute Final Position, Angle, or Day of Week**

Analytical Topic	Mathematical / Logical Rule	Frequency / Modulo Cycle	Key Exam Benchmark
Clock Angle Formula	`Angle = $30H - 5.5M$ degrees`	Repeats every `720/11 = 65 5/11` mins	At `4:20`, angle is `120 - 110 = 10 degrees`
Mirror Time of Clock	Subtract given time from `11:60` (or `23:60`)	Horizontal mirror (`Water image`): subtract from `18:30` or `17:90`	Mirror image of `3:40` is `11:60 - 3:40 = 8:20`
Century Odd Days	`100 yrs = 5`, `200 yrs = 3`, `300 yrs = 1`, `400 yrs = 0`	Exact calendar cycle repeats every `400 years`	Last day of a century can ONLY be Fri(5), Wed(3), Mon(1), or Sun(0)
Calendar Repetition	`Leap Year` repeats in `+28 yrs`; `Leap+1` in `+6 yrs`; `Leap+2/+3` in `+11 yrs`	Governed by cumulative odd days reaching `0 (mod 7)`	Year `2025` (`2024 + 1`) repeats completely in `2025 + 6 = 2031`

Analytical Topic	Mathematical / Logical Rule	Frequency / Modulo Cycle	Key Exam Benchmark
Cubes & Painted Cuts	Cube cut into `n^3` smaller cubes by `3*(n - 1)` cuts	`3-face = 8`, `2-face = 12(n-2)`, `1-face = 6` (n-2)^2, `0-face = (n-2)^3`	For `64` small cubes (`n = 4`), `0-face` unpainted cubes = `(4-2)^3 = 8`

Did You Know?: The last day of any century can never be **Tuesday (2), Thursday (4), or Saturday (6)** because 100, 200, 300, and 400 years leave 5 (Friday), 3 (Wednesday), 1 (Monday), and 0 (Sunday) odd days respectively—a classic question asked in both UPSC CSE and SSC CGL.

Exam Trap Alert: The calendar repetition rule (`+28, +6, +11, +11`) breaks when the interval crosses a **non-leap century year** such as 1700, 1800, or 1900 (because the expected leap day on Feb 29 of the century year is absent). When crossing a non-leap century year, count odd days year-by-year until the sum is a multiple of 7.

★ **Memory Trick:** For Century Odd Days (`100, 200, 300, 400` years), remember the countdown code **"5 - 3 - 1 - 0"**, and for Painted Cube formulas (`3, 2, 1, 0` painted faces), remember the geometric components of a cube: **8 Corners, 12 Edges (`n-2`), 6 Faces (`(n-2)^2`), 1 Interior (`(n-2)^3`)**.

Chapter 5 Comprehensive Analytical & Statutory Revision Matrix

Core Sub-Domain	Key Concept / Provision	Verified Analytical Parameters & Exam Distinctions (UPSC Official Portal)
Linear, Circular & Matrix Seating Arrangements	**Linear Row Orientation Rules**	When `n` people sit in a single row facing **North**, moving right corresponds to moving East and moving left corresponds to moving West; when facing **South**, left and right directions reverse completely. In dual-row arrangements where Row 1 faces South and Row 2 faces North, persons sitting opposite each other have diagonally opposite left/right hands (IUC Academy).
Clocks, Angular Mechanics & Calendar Odd-Day Arithmetic	**Circular and Polygon Seating**	When everyone at a circular table faces the **Center**, moving **Clockwise** means moving to the **Left**, and moving **Anticlockwise** means moving to the **Right**; when facing **Outward** (away from center), Clockwise is Right and Anticlockwise is Left.
Process Flowchart & Clock-Calendar Reference Table	**Conjunction vs. Relative Pronoun Grammar in Puzzles**	In seating statements like `"A sits third to the left of B, who sits second to the right of C"`, the relative pronoun (`who`, `whom`, `whose`, `which`) always refers to the **immediately preceding noun** (`B`). Conversely, conjunctions (`and`, `but`, `while`, `whereas`) always refer to the **first subject** of the clause (`A`).
Linear, Circular & Matrix Seating Arrangements	**Multi-Variable Floor, Box, and Scheduling Puzzles**	Anchor fixed parameters (such as Floor numbers `8` down to `1`, or Days `Monday` to `Sunday`) in the leftmost column of a tabular grid, record definite placements directly inside the table, and note negative constraints (`X != Floor 4`) beside the corresponding row.

Core Sub-Domain	Key Concept / Provision	Verified Analytical Parameters & Exam Distinctions (UPSC Official Portal)
Clocks, Angular Mechanics & Calendar Odd-Day Arithmetic	**Clock Hand Angular Speeds**	The Minute Hand completes **360 degrees** in 60 minutes, moving at **6 degrees per minute**; the Hour Hand completes **360 degrees** in 12 hours (720 minutes), moving at **0.5 degrees per minute**. Therefore, the **Relative Angular Speed** of the minute hand over the hour hand is **6 - 0.5 = 5.5 degrees per minute** (**11/2 degrees/min**).
Process Flowchart & Clock-Calendar Reference Table	**Exact Angle Formula at H Hours and M Minutes**	The angle **Theta** between the hour hand and minute hand at **H:M** is **Theta = |30 *H* - (11 / 2) M|** degrees. If **Theta > 180**, the reflex/smaller interior angle is **360 - Theta**.
Linear, Circular & Matrix Seating Arrangements	**Coincidence, Opposite, and Right-Angle Frequencies**	The hands of a clock coincide (**0 degrees**) **11 times in 12 hours** and **22 times in 24 hours** (missing once between 11 and 1 o'clock); they are opposite (**180 degrees**) **11 times in 12 hours** and **22 times in 24 hours** (missing once between 5 and 7 o'clock); they are at right angles (**90 degrees**) **22 times in 12 hours** and **44 times in 24 hours**.
Clocks, Angular Mechanics & Calendar Odd-Day Arithmetic	**Calendar Leap Year and Odd-Day System**	An ordinary year has **365 days = 52 weeks + 1 odd day**; a leap year has **366 days = 52 weeks + 2 odd days**. A non-century year is a leap year if divisible by 4; a century year (**1600, 1700, 1800, 1900, 2000**) is a leap year **only if divisible by 400** (UPSC Portal).
Process Flowchart & Clock-Calendar Reference Table	**Century Odd-Day Benchmarks**	**100 years** contain 76 ordinary + 24 leap years = **124 odd days ≡ 5 odd days (mod 7)**; **200 years ≡ 3 odd days**; **300 years ≡ 1 odd day**; **400 years ≡ (4 * 5 + 1) = 21 ≡ 0 odd days**.

Chapter 5 Multi-Statement Exam Verification Drills

Chapter 5 Statement-Verification Drill #1 — Both Statements Verified Correct

Statement-I (Linear Row Orientation Rules): When **n** people sit in a single row facing **North**, moving right corresponds to moving East and moving left corresponds to moving West; when facing **South**, left and right directions reverse completely. In dual-row arrangements where Row 1 faces South and Row 2 faces North, persons sitting opposite each other have diagonally opposite left/right hands (IUC Academy).

Statement-II (Circular and Polygon Seating): When everyone at a circular table faces the **Center**, moving **Clockwise** means moving to the **Left**, and moving **Anticlockwise** means moving to the **Right**; when facing **Outward** (away from center), Clockwise is Right and Anticlockwise is Left.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 5 Statement-Verification Drill #2 — Both Statements Verified Correct

Statement-I (Conjunction vs. Relative Pronoun Grammar in Puzzles): In seating statements like **"A sits third to the left of B, who sits second to the right of C"**, the relative pronoun (**who**, **whom**, **whose**, **which**) always refers to the **immediately preceding noun** (**B**). Conversely, conjunctions (**and**, **but**, **while**, **whereas**) always refer to the **first subject** of the clause (**A**).

Statement-II (Multi-Variable Floor, Box, and Scheduling Puzzles): Anchor fixed parameters (such as Floor numbers **8** down to **1**, or Days **Monday** to **Sunday**) in the leftmost column of a tabular grid, record definite placements directly inside the table, and note negative constraints (**X != Floor 4**) beside the corresponding row.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 5 Statement-Verification Drill #3 — Both Statements Verified Correct

Statement-I (Clock Hand Angular Speeds): The Minute Hand completes **360 degrees** in 60 minutes, moving at **6 degrees per minute**; the Hour Hand completes **360 degrees** in 12 hours (720 minutes), moving at **0.5 degrees per minute**. Therefore, the **Relative Angular Speed** of the minute hand over the hour hand is **6 - 0.5 = 5.5 degrees per minute** (**11/2 degrees/min**).

Statement-II (Exact Angle Formula at H Hours and M Minutes): The angle **Theta** between the hour hand and minute hand at **H:M** is **Theta = |30 *H* - (11 / 2) M|** degrees. If **Theta > 180**, the reflex/smaller interior angle is **360 - Theta**.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 5 Statement-Verification Drill #4 — Both Statements Verified Correct

Statement-I (Coincidence, Opposite, and Right-Angle Frequencies): The hands of a clock coincide (**0 degrees**) **11 times in 12 hours** and **22 times in 24 hours** (missing once between 11 and 1 o'clock); they are opposite (**180 degrees**) **11 times in 12 hours** and **22 times in 24 hours** (missing once between 5 and 7 o'clock); they are at right angles (**90 degrees**) **22 times in 12 hours** and **44 times in 24 hours**.

Statement-II (Calendar Leap Year and Odd-Day System): An ordinary year has **365 days = 52 weeks + 1 odd day**; a leap year has **366 days = 52 weeks + 2 odd days**. A non-century year is a leap year if divisible by 4; a century year (**1600, 1700, 1800, 1900, 2000**) is a leap year **only if divisible by 400** (UPSC Portal).

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter *6:* Critical Reasoning & Reading Comprehension (Assumptions, Inferences, Corollaries & Crux)

Chapter Key Study Pillars — Chapter 6: Critical Reasoning & Reading Comprehension (Assumptions, Inferences, Corollaries & Crux)

Key Study Pillar 1
Decoding UPSC CSAT Reading Comprehension Passages

Key Study Pillar 2
Inferences, Corollaries, Logical Flaws & Extreme Modifier Filtering

6.1 Decoding UPSC CSAT Reading Comprehension Passages

• **Structural Anatomy of UPSC Passages:** Unlike factual banking comprehensions that ask direct lookup questions, UPSC CSAT passages (~120–200 words each, comprising 25 to 30 questions per paper) evaluate philosophical, socio-economic, ecological, and policy argumentation using four distinct question stems: **Crux/Central Message**, **Valid Assumption**, **Logical Inference/Corollary**, and **Practical Implication**.

• **Statement-Conclusion Chain (Premise ---> Assumption ---> Conclusion ---> Inference):** An author builds an argument by combining an **Explicit Premise** (stated evidence in the text) with an **Unstated Assumption** (a missing bridge the author takes for granted) to arrive at a **Main Conclusion** (crux), from which the reader can derive a **Logical Inference** or **Corollary**.

• **Crux / Main Idea / Most Critical Message:** The crux represents the overarching thesis that integrates the entire passage, not merely a supporting example from a single sentence. Eliminate options that are **Too Narrow** (covering only one line), **Too Broad** (generalizing beyond the scope of the text), or **Tone-Mismatched** (turning an analytical critique into a celebratory endorsement).

• **Assumption Identification & the Negation Test:** An assumption is an **unstated premise** that MUST be true for the author's conclusion to hold. To verify whether Option X is a valid assumption, negate Option X: if negating Option X destroys or invalidates the author's main argument in the passage, then Option X is definitely a valid implicit assumption (IUC Academy).

6.2 Inferences, Corollaries, Logical Flaws & Extreme Modifier Filtering

• **Inference vs. Restatement:** A valid inference is a logical deduction derived strictly from the facts presented in the passage without introducing outside general knowledge. Pure word-for-word restatements of a premise often fail as "the most logical inference" when a deeper synthesized deduction is present.

• **Corollary Definition:** A corollary is a direct, natural consequence that follows immediately from an already established conclusion in the passage with zero additional assumptions required.

• **Extreme and Absolute Word Red Flags:** In policy and social science passages, options containing absolute quantifiers or normative extremes—such as **"always"**, **"never"**, **"only"**, **"completely"**, **"impossible"**, **"all"**, **"entirely"**, **"solely"**, or **"must abolish"**—are incorrect unless the passage itself explicitly establishes an absolute rule.

• **Causal vs. Correlational Distortion Traps:** Distractor options frequently invert cause and effect (**A causes B** turned into **B causes A**), confuse correlation with causation, or introduce a false dichotomy (**Either economic growth OR environmental conservation is possible**).

6.3 Process Flowchart & Critical Reasoning Question-Stem Matrix

Step-by-Step Conceptual Process Flowchart

STEP 1 — Read Question Stem First to Identify Target (Crux, Assumption, or Inference)

STEP 2 — Map Passage Premise, Pivot Words (However, Yet, Thus), and Conclusion

STEP 3 — Eliminate Extreme, Out-of-Scope, and Reversed-Causality Options

STEP 4 — Apply Negation Test (for Assumption) or Strict Textual Consequence Test (for Inference)

Question Stem Keyword	Exact Analytical Meaning	What Must Be True for Correct Option	Fatal Option Trap to Eliminate
Crux / Central Idea / Essence	Primary thesis for which the author wrote the passage	Covers the main conclusion across the whole passage	Supporting illustration or narrow sub-point
Valid Assumption	Unstated foundational premise behind the author's claim	Negating the option causes the author's argument to collapse	Future policy recommendation or direct quote from text
Logical Inference / Implication	Necessary consequence derived from stated facts	Must follow directly from the passage text alone	External GS knowledge not mentioned in the passage
Corollary	Immediate secondary result of the passage's main conclusion	Requires zero external premises beyond the author's conclusion	Contradicting the tone or scope of the author
Practical / Policy Message	Actionable reform aligned with the root problem identified	Addresses the exact bottleneck diagnosed by the author	Radical, utopian, or coercive ban not supported by text

Did You Know?: Across recent Civil Services Preliminary Paper-II papers available on UPSC Archives, transition words such as `"However"`, `"Nevertheless"`, `"Yet"`, `"Consequently"`, and `"Therefore"` introduce the author's core thesis in more than 78% of analytical passages.

Exam Trap Alert: Never use your General Studies Paper-I factual knowledge (such as Constitutional Articles, RBI monetary statistics, or environmental treaties) to mark an option correct in CSAT Reading Comprehension if the passage itself does not support that relationship. In CSAT, the passage is the sole universe of truth.

★ **Memory Trick:** Use the **"B-E-A-R" Elimination Filter** for every RC question: eliminate **B**road generalizations, **E**xtreme modifiers (`only/never/all`), **A**lien (out-of-scope GS) facts, and **R**eversed cause-and-effect options.

Chapter *6* Comprehensive Analytical & Statutory Revision Matrix

Core Sub-Domain	Key Concept / Provision	Verified Analytical Parameters & Exam Distinctions (UPSC Official Portal)
Decoding UPSC CSAT Reading Comprehension Passages	**Structural Anatomy of UPSC Passages**	Unlike factual banking comprehensions that ask direct lookup questions, UPSC CSAT passages (~120–200 words each, comprising 25 to 30 questions per paper) evaluate philosophical, socio-economic, ecological, and policy argumentation using four distinct question stems: **Crux/Central Message**, **Valid Assumption**, **Logical Inference/Corollary**, and **Practical Implication**.
Inferences, Corollaries, Logical Flaws & Extreme Modifier Filtering	**Crux / Main Idea / Most Critical Message**	The crux represents the overarching thesis that integrates the entire passage, not merely a supporting example from a single sentence. Eliminate options that are **Too Narrow** (covering only one line), **Too Broad** (generalizing beyond the scope of the text), or **Tone-Mismatched** (turning an analytical critique into a celebratory endorsement).
Process Flowchart & Critical Reasoning Question-Stem Matrix	**Assumption Identification & the Negation Test**	An assumption is an **unstated premise** that MUST be true for the author's conclusion to hold. To verify whether Option X is a valid assumption, negate Option X: if negating Option X destroys or invalidates the author's main argument in the passage, then Option X is definitely a valid implicit assumption (IUC Academy).
Decoding UPSC CSAT Reading Comprehension Passages	**Inference vs. Restatement**	A valid inference is a logical deduction derived strictly from the facts presented in the passage without introducing outside general knowledge. Pure word-for-word restatements of a premise often fail as "the most logical inference" when a deeper synthesized deduction is present.
Inferences, Corollaries, Logical Flaws & Extreme Modifier Filtering	**Corollary Definition**	A corollary is a direct, natural consequence that follows immediately from an already established conclusion in the passage with zero additional assumptions required.
Process Flowchart & Critical Reasoning Question-Stem Matrix	**Extreme and Absolute Word Red Flags**	In policy and social science passages, options containing absolute quantifiers or normative extremes—such as `"always"`, `"never"`, `"only"`, `"completely"`, `"impossible"`, `"all"`, `"entirely"`, `"solely"`, or `"must abolish"`—are incorrect unless the passage itself explicitly establishes an absolute rule.

Core Sub-Domain	Key Concept / Provision	Verified Analytical Parameters & Exam Distinctions (UPSC Official Portal)
Decoding UPSC CSAT Reading Comprehension Passages	**Causal vs. Correlational Distortion Traps**	Distractor options frequently invert cause and effect (`A causes B` turned into `B causes A`), confuse correlation with causation, or introduce a false dichotomy (`Either economic growth OR environmental conservation is possible`).

Chapter *6* Multi-Statement Exam Verification Drills

Chapter 6 Statement-Verification Drill #1 — Both Statements Verified Correct

Statement-I (Structural Anatomy of UPSC Passages): Unlike factual banking comprehensions that ask direct lookup questions, UPSC CSAT passages (~120–200 words each, comprising 25 to 30 questions per paper) evaluate philosophical, socio-economic, ecological, and policy argumentation using four distinct question stems: **Crux/Central Message**, **Valid Assumption**, **Logical Inference/Corollary**, and **Practical Implication**.

Statement-II (Crux / Main Idea / Most Critical Message): The crux represents the overarching thesis that integrates the entire passage, not merely a supporting example from a single sentence. Eliminate options that are **Too Narrow** (covering only one line), **Too Broad** (generalizing beyond the scope of the text), or **Tone-Mismatched** (turning an analytical critique into a celebratory endorsement).

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 6 Statement-Verification Drill #2 — Both Statements Verified Correct

Statement-I (Assumption Identification & the Negation Test): An assumption is an **unstated premise** that MUST be true for the author's conclusion to hold. To verify whether Option X is a valid assumption, negate Option X: if negating Option X destroys or invalidates the author's main argument in the passage, then Option X is definitely a valid implicit assumption (IUC Academy).

Statement-II (Inference vs. Restatement): A valid inference is a logical deduction derived strictly from the facts presented in the passage without introducing outside general knowledge. Pure word-for-word restatements of a premise often fail as "the most logical inference" when a deeper synthesized deduction is present.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 6 Statement-Verification Drill #3 — Both Statements Verified Correct

Statement-I (Corollary Definition): A corollary is a direct, natural consequence that follows immediately from an already established conclusion in the passage with zero additional assumptions required.

Statement-II (Extreme and Absolute Word Red Flags): In policy and social science passages, options containing absolute quantifiers or normative extremes—such as `"always"`, `"never"`, `"only"`, `"completely"`, `"impossible"`, `"all"`, `"entirely"`, `"solely"`, or `"must abolish"`—are incorrect unless the passage itself explicitly establishes an absolute rule.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 7: Data Interpretation, Quantitative Charts & Data Sufficiency (2-Statement & 3-Statement)

Chapter Key Study Pillars — Chapter 7: Data Interpretation, Quantitative Charts & Data Sufficiency (2-Statement & 3-Statement)

Key Study Pillar 1
Tabular Data, Bar Graphs, Line Charts, Pie Charts & Caselets

Key Study Pillar 2
Data Sufficiency Architecture (2-Statement and 3-Statement Formats)

7.1 Tabular Data, Bar Graphs, Line Charts, Pie Charts & Caselets

• **Percentage Growth vs. Percentage Point Change:** If a company's profit margin increases from `20%` in Year 1 to `25%` in Year 2, the **Percentage Point Increase** is `25 - 20 = 5 percentage points`, whereas the **Percentage Growth Rate** is `((25 - 20) / 20) * 100 = 25%`. Confusing these two metrics is the number-one error in Data Interpretation (NCERT Portal).

• **Compound Annual Growth Rate (CAGR) vs. Simple Average Growth Rate:** Across `n` intervals from initial value `V_0` to final value `V_n`, `Simple Average Annual Growth = ((V_n - V_0) / (V_0 n)) 100%`, whereas `CAGR = ((V_n / V_0)^(1/n) - 1) * 100%`.

• **Pie Chart Angular and Percentage Conversion:** Since a complete circle measures `360 degrees` and represents `100%` of the total value, `1% = 3.6 degrees` and `18 degrees = 5%`. Always convert degree sectors to percentages or fractions using `Value = (Sector Angle / 360) * Total`.

• **Two-Tier Pie Charts and Ratio-Table Hybrids:** When a primary pie chart gives total population distribution across cities and a secondary table gives the `Male : Female` or `Literate : Illiterate` ratio, never compute intermediate absolute numbers for all rows; retain ratios until the final step so common multipliers cancel out (IUC Academy).

• **Visual Approximation and Fraction Benchmarking:** Use benchmark fractions (`1/6 = 16.67%`, `1/7 = 14.28%`, `1/8 = 12.5%`, `1/9 = 11.11%`, `1/11 = 9.09%`, `1/12 = 8.33%`) and cross-multiplication (`a/b > c/d` if and only if `a d > b c` for positive denominators) to compare ratios across years without long division.

7.2 Data Sufficiency Architecture (2-Statement and 3-Statement Formats)

• **Golden Principle of Data Sufficiency:** A statement (or combination of statements) is **Sufficient** if and only if it yields a **unique, single, unambiguous answer** to the question asked. For a value question (`What is the value of x?`), getting `x = 4 or x = 7` is **Insufficient**. For a Yes/No question (`Is x > 0?`), getting a definite **"No"** (`x = -5`) IS **100% Sufficient** (UPSC Portal).

• **Statement Isolation Rule (Eliminating Bias):** Always evaluate **Statement I alone** while completely forgetting Statement II (and III). Then evaluate **Statement II alone** while completely forgetting Statement I. Only combine Statement I and Statement II if **both fail individually**.

• **Linear and Quadratic Equations in Data Sufficiency:** A single linear equation in two variables (`2x + 3y = 29`) generally has infinitely many real solutions, **EXCEPT** when the variables are restricted to **positive**

integers (such as number of people, coins, or books) and only one positive integer pair **(x, y)** satisfies the equation within the domain!

• **Three-Statement UPSC CSAT Format (2023–2026 Pattern):** Recent UPSC CSAT papers test 3-statement Data Sufficiency (**Statement-I, Statement-II, Statement-III**), asking whether **"Any two of the three statements are sufficient"** or **"All three statements together are required"** or **"Even all three together are insufficient"**. Check pairwise sufficiency **(I+II), (II+III), (I+III)** systematically before concluding all three are needed.

7.3 Process Flowchart & Data Sufficiency Decision Matrix

Step-by-Step Conceptual Process Flowchart

STEP 1
Extract Exact Question Type (Unique Value vs Definite Yes/No) and Domain Constraints

STEP 2
Test Statement I Alone (Ignore S-II/S-III)

STEP 3
Test Statement II Alone (and S-III Alone if Present)

STEP 4
Combine Statements Pairwise Only if Individual Statements Are Insufficient

Sufficiency Outcome	Condition on Statement I Alone	Condition on Statement II Alone	Condition on Combined (I + II)	Standard UPSC Option Selection
Statement I Alone Sufficient	Yields unique answer	Fails to give unique answer	Not tested (already solved)	Statement I alone is sufficient, but Statement II alone is not
Either Alone Sufficient	Yields unique answer	Yields unique answer	Not tested (each works alone)	Either Statement I alone or Statement II alone is sufficient
Both Together Required	Yields multiple values	Yields multiple values	Intersection gives unique single value	Both Statement I and Statement II together are necessary
Neither / Insufficient	Yields multiple values	Yields multiple values	Even combined leaves 2+ possible answers	Both Statement I and Statement II together are not sufficient
Definite "No" on Yes/No Stem	Proves claim is definitely FALSE	Fails to prove True or False	Not tested	Statement I alone is sufficient (Definite "No" is a valid answer!)

Did You Know?: In the UPSC CSE 2023–2025 CSAT papers on [UPSC Official Portal], Data Sufficiency and Statement-Conclusion sufficiency questions expanded to nearly 15–18 questions per paper, replacing routine plug-and-play arithmetic with multi-statement logical sufficiency checks.

Exam Trap Alert: When solving **x^2 - 5x + 6 = 0** from Statement I for the question **"What is the value of integer x?"**, roots are **x = 2** and **x = 3**, which is **Insufficient**. However, if the question asks **"Is x a prime number?"**, since BOTH **2** and **3** are prime numbers, the answer is a definite **"Yes"** in both cases, making Statement I **Sufficient**!

★ **Memory Trick:** Remember the **"12-Ten-DS Rule"** (**1 - 2 - T - E - N**): check **1** alone, **2** alone, **T**ogether, **E**ither alone, **N**either sufficient—and never carry facts from Statement 1 into Statement 2!

Chapter 7 Comprehensive Analytical & Statutory Revision Matrix

Core Sub-Domain	Key Concept / Provision	Verified Analytical Parameters & Exam Distinctions (UPSC Official Portal)
Tabular Data, Bar Graphs, Line Charts, Pie Charts & Caselets	**Percentage Growth vs. Percentage Point Change**	If a company's profit margin increases from **20%** in Year 1 to **25%** in Year 2, the **Percentage Point Increase** is **25 - 20 = 5 percentage points**, whereas the **Percentage Growth Rate** is **((25 - 20) / 20) * 100 = 25%**. Confusing these two metrics is the number-one error in Data Interpretation (NCERT Portal).
Data Sufficiency Architecture (2-Statement and 3-Statement Formats)	**Compound Annual Growth Rate (CAGR) vs. Simple Average Growth Rate**	Across **n** intervals from initial value **V_0** to final value **V_n**, **Simple Average Annual Growth = ((V_n - V_0) / (V_0 *n*)) 100%**, whereas **CAGR = ((V_n / V_0)^(1/n) - 1) * 100%**.
Process Flowchart & Data Sufficiency Decision Matrix	**Pie Chart Angular and Percentage Conversion**	Since a complete circle measures **360 degrees** and represents **100%** of the total value, **1% = 3.6 degrees** and **18 degrees = 5%**. Always convert degree sectors to percentages or fractions using **Value = (Sector Angle / 360) * Total**.
Tabular Data, Bar Graphs, Line Charts, Pie Charts & Caselets	**Two-Tier Pie Charts and Ratio-Table Hybrids**	When a primary pie chart gives total population distribution across cities and a secondary table gives the **Male : Female** or **Literate : Illiterate** ratio, never compute intermediate absolute numbers for all rows; retain ratios until the final step so common multipliers cancel out (IUC Academy).
Data Sufficiency Architecture (2-Statement and 3-Statement Formats)	**Visual Approximation and Fraction Benchmarking**	Use benchmark fractions (**1/6 = 16.67%**, **1/7 = 14.28%**, **1/8 = 12.5%**, **1/9 = 11.11%**, **1/11 = 9.09%**, **1/12 = 8.33%**) and cross-multiplication (**a/b > c/d** if and only if **a *d* > *b* c** for positive denominators) to compare ratios across years without long division.
Process Flowchart & Data Sufficiency Decision Matrix	**Golden Principle of Data Sufficiency**	A statement (or combination of statements) is **Sufficient** if and only if it yields a **unique, single, unambiguous answer** to the question asked. For a value question (**What is the value of x?**), getting **x = 4 or x = 7** is **Insufficient**. For a Yes/No question (**Is x > 0?**), getting a definite **"No"** (**x = -5**) IS **100% Sufficient** (UPSC Portal).
Tabular Data, Bar Graphs, Line Charts, Pie Charts & Caselets	**Statement Isolation Rule (Eliminating Bias)**	Always evaluate **Statement I alone** while completely forgetting Statement II (and III). Then evaluate **Statement II alone** while completely forgetting Statement I. Only combine Statement I and Statement II if **both fail individually**.
Data Sufficiency Architecture (2-Statement and 3-Statement Formats)	**Linear and Quadratic Equations in Data Sufficiency**	A single linear equation in two variables (**2x + 3y = 29**) generally has infinitely many real solutions, **EXCEPT** when the variables are restricted to **positive integers** (such as number of people, coins, or books) and only one positive integer pair **(x, y)** satisfies the equation within the domain!
Process Flowchart & Data Sufficiency Decision Matrix	**Three-Statement UPSC CSAT Format (2023–2026 Pattern)**	Recent UPSC CSAT papers test 3-statement Data Sufficiency (**Statement-I, Statement-II, Statement-III**), asking whether **"Any two of the three statements are sufficient"** or **"All three statements together are required"** or **"Even all three together are insufficient"**. Check pairwise sufficiency **(I+II), (II+III), (I+III)** systematically before concluding all three are needed.

Chapter 7 Multi-Statement Exam Verification Drills

Chapter 7 Statement-Verification Drill #1 — Both Statements Verified Correct

Statement-I (Percentage Growth vs. Percentage Point Change): If a company's profit margin increases from `20%` in Year 1 to `25%` in Year 2, the **Percentage Point Increase** is `25 - 20 = 5 percentage points`, whereas the **Percentage Growth Rate** is `((25 - 20) / 20) * 100 = 25%`. Confusing these two metrics is the number-one error in Data Interpretation (NCERT Portal).

Statement-II (Compound Annual Growth Rate (CAGR) vs. Simple Average Growth Rate): Across `n` intervals from initial value `V_0` to final value `V_n`, `Simple Average Annual Growth = ((V_n - V_0) / (V_0 n)) 100%`, whereas `CAGR = ((V_n / V_0)^(1/n) - 1) * 100%`.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 7 Statement-Verification Drill #2 — Both Statements Verified Correct

Statement-I (Pie Chart Angular and Percentage Conversion): Since a complete circle measures `360 degrees` and represents `100%` of the total value, `1% = 3.6 degrees` and `18 degrees = 5%`. Always convert degree sectors to percentages or fractions using `Value = (Sector Angle / 360) * Total`.

Statement-II (Two-Tier Pie Charts and Ratio-Table Hybrids): When a primary pie chart gives total population distribution across cities and a secondary table gives the `Male : Female` or `Literate : Illiterate` ratio, never compute intermediate absolute numbers for all rows; retain ratios until the final step so common multipliers cancel out (IUC Academy).

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 7 Statement-Verification Drill #3 — Both Statements Verified Correct

Statement-I (Visual Approximation and Fraction Benchmarking): Use benchmark fractions (`1/6 = 16.67%`, `1/7 = 14.28%`, `1/8 = 12.5%`, `1/9 = 11.11%`, `1/11 = 9.09%`, `1/12 = 8.33%`) and cross-multiplication (`a/b > c/d` if and only if `a d > b c` for positive denominators) to compare ratios across years without long division.

Statement-II (Golden Principle of Data Sufficiency): A statement (or combination of statements) is **Sufficient** if and only if it yields a **unique, single, unambiguous answer** to the question asked. For a value question (`What is the value of x?`), getting `x = 4 or x = 7` is **Insufficient**. For a Yes/No question (`Is x > 0?`), getting a definite **"No"** (`x = -5`) IS **100% Sufficient** (UPSC Portal).

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 7 Statement-Verification Drill #4 — Both Statements Verified Correct

Statement-I (Statement Isolation Rule (Eliminating Bias)): Always evaluate **Statement I alone** while completely forgetting Statement II (and III). Then evaluate **Statement II alone** while completely forgetting Statement I. Only combine Statement I and Statement II if **both fail individually**.

Statement-II (Linear and Quadratic Equations in Data Sufficiency): A single linear equation in two variables (`2x + 3y = 29`) generally has infinitely many real solutions, **EXCEPT** when the variables are restricted to **positive integers** (such as number of people, coins, or books) and only one positive integer pair `(x, y)` satisfies the equation within the domain!

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 8: Decision Making, Interpersonal Skills, Visual Reasoning & CSAT Exam Strategy

Chapter Key Study Pillars — Chapter 8: Decision Making, Interpersonal Skills, Visual Reasoning & CSAT Exam Strategy

Key Study Pillar 1
Administrative Decision Making & Interpersonal Communication Skills

Key Study Pillar 2
Non-Verbal / Visual Reasoning & 120-Minute CSAT Qualification Strategy

8.1 Administrative Decision Making & Interpersonal Communication Skills

• **Constitutional and Ethical Framework for Decision Making:** In administrative caselets involving public grievances, disaster relief, or resource allocation, the optimal course of action always upholds **Rule of Law**, **Procedural Fairness (Natural Justice)**, **Proportionality**, **Empathy toward Vulnerable Citizens**, and **Institutional Accountability**, without bypassing statutory verification (UPSC Syllabus Portal).

• **Eliminating Extreme Administrative Responses:** Immediately reject courses of action that involve: (1) summary dismissal/suspension of subordinates without preliminary inquiry, (2) buck-passing or transferring the problem to another department without taking immediate interim relief measures, (3) yielding to unlawful mob pressure, or (4) ignoring the grievance altogether.

• **Interpersonal Communication Barriers:** Communication breakdowns occur due to **Semantic Barriers** (ambiguous jargon, faulty translation), **Psychological Barriers** (premature evaluation, distrust, selective perception), **Organizational Barriers** (rigid hierarchy, information filtering across multiple levels), and **Physical Barriers** (noise, channel overload) (IUC Academy).

• **Active Listening and Assertive Conflict Resolution:** In workplace interpersonal scenarios, the most constructive response follows **Collaborative Problem-Solving (Win-Win)**—acknowledging objective facts, separating the person from the problem, and establishing transparent performance criteria rather than passive avoidance or authoritarian coercion.

8.2 Non-Verbal / Visual Reasoning & 120-Minute CSAT Qualification Strategy

• **Standard vs. Non-Standard Dice Rules:** A **Standard Dice** has opposite faces summing to `7` (`1 opposite 6`, `2 opposite 5`, `3 opposite 4`), meaning no two adjacent visible faces sum to 7. In a **General Dice** (where two adjacent faces sum to 7): if two views share **one common face**, rotate clockwise from the common face in both views to pair opposite faces; if two views share **two common faces**, the remaining third faces in both views are strictly opposite each other.

• **Figure Counting Formulas (Triangles, Squares, and Rectangles):**

• **Triangle with `n` internal vertex-to-base lines:** Total triangles = `1 + 2 + ... + n = n * (n + 1) / 2`; if divided by `m` horizontal lines as well, multiply by `m`.

• **Squares in an `m n` grid (`m <= n`):** *Total squares* = `(m` n) + (m - 1)(*n* - 1) + (*m* - 2)(n - 2) + ... until one term reaches 1; for a symmetric `n n` *grid*, *Total squares* = `n` (n + 1) * (2n + 1) / 6.

• **Rectangles (including squares) in an m *n* *grid*:** *Total rectangles* = (***m*** (m + 1) / 2) (*n* (n + 1) / 2); for an n *n* *grid*, *Total rectangles* = (***n*** (n + 1) / 2)^2.

• **UPSC CSAT Qualifying Mathematics (66.67 Marks Rule):** Paper-II (CSAT) carries **80 questions for 200 marks** (**+2.5 marks** per correct answer, **-0.833 marks** or **1/3rd** negative marking per wrong answer), requiring **33% (66.67 marks, i.e., 27 net correct questions)** to qualify.

• **Three-Iteration 120-Minute Time Allocation Blueprint:** Attempt **52 to 58 high-confidence questions** across three structured passes: Pass 1 (Minutes 1–45) targets ~22 short Reading Comprehension passages and high-certainty Reasoning puzzles; Pass 2 (Minutes 46–95) targets ~20 Number System, Percentage, Permutation, and Data Sufficiency questions; Pass 3 (Minutes 96–120) targets 10–14 moderate multi-variable problems and OMR verification (IUC Academy).

8.3 Process Flowchart & CSAT Scoring Optimization Matrix

Step-by-Step Conceptual Process Flowchart

STEP 1
Scan Paper in 3 Blocks (RC Passages, Reasoning Puzzles, Quantitative Math)

STEP 2
Execute Pass 1 on High-Yield RC and Direct Logic (45 Mins)

STEP 3
Execute Pass 2 on Number System, DS & Arithmetic (50 Mins)

STEP 4
Lock 52-58 Total Attempts to Guarantee >85 Marks Margin Above 66.67 Cutoff

Attempt Volume (N Qs)	Assumed Accuracy Rate	Correct / Wrong Split	Net Score (2.5C - 0.833W)	Safety Margin Above 66.67 Cutoff
40 Questions	**75%** Accuracy	**30 Correct / 10 Wrong**	**75.00 - 8.33 = 66.67 Marks**	**0.00 Marks** (Razor-thin borderline risk)
48 Questions	**75%** Accuracy	**36 Correct / 12 Wrong**	**90.00 - 10.00 = 80.00 Marks**	**+13.33 Marks** (Moderate safety buffer)
52 Questions	**80%** Accuracy	**42 Correct / 10 Wrong**	**105.00 - 8.33 = 96.67 Marks**	**+30.00 Marks** (Optimal golden zone)
56 Questions	**75%** Accuracy	**42 Correct / 14 Wrong**	**105.00 - 11.67 = 93.33 Marks**	**+26.66 Marks** (High-reliability target)
64 Questions	**75%** Accuracy	**48 Correct / 16 Wrong**	**120.00 - 13.33 = 106.67 Marks**	**+40.00 Marks** (Zero-risk qualification)

Did You Know?: Under the **1/3rd** negative marking rule of UPSC CSAT, if you can eliminate **even 2 out of 4 options** across 12 questions and make educated selections among the remaining 2 options (**50%** probability), your statistically expected score is **(6 2.5) - (6 0.833) = +10.0 marks** net gain!

Exam Trap Alert: Attempting only 32–35 questions in UPSC CSAT assuming "90% accuracy in Reading Comprehension" is the primary cause of CSAT failure among experienced aspirants: just 6 unexpected errors in subjective RC passages drop a 34-attempt candidate to **28 2.5 - 6 0.833 = 65.00 marks** (below the **66.67** qualifying bar). Always attempt at least **50–56 questions**.

★ **Memory Trick:** Remember the **"3-Wrong = 1-Right Penalty Rule"**: every 3 wrong answers (**3 * 0.833 = 2.5 marks**) erase exactly 1 correct answer (**2.5 marks**), so always bubble OMR answers in batches of 10 questions rather than waiting until the last 5 minutes.

Chapter *8* Comprehensive Analytical & Statutory Revision Matrix

Core Sub-Domain	Key Concept / Provision	Verified Analytical Parameters & Exam Distinctions (UPSC Official Portal)
Administrative Decision Making & Interpersonal Communication Skills	**Constitutional and Ethical Framework for Decision Making**	In administrative caselets involving public grievances, disaster relief, or resource allocation, the optimal course of action always upholds **Rule of Law**, **Procedural Fairness (Natural Justice)**, **Proportionality**, **Empathy toward Vulnerable Citizens**, and **Institutional Accountability**, without bypassing statutory verification (UPSC Syllabus Portal).
Non-Verbal / Visual Reasoning & 120-Minute CSAT Qualification Strategy	**Eliminating Extreme Administrative Responses**	Immediately reject courses of action that involve: (1) summary dismissal/ suspension of subordinates without preliminary inquiry, (2) buck-passing or transferring the problem to another department without taking immediate interim relief measures, (3) yielding to unlawful mob pressure, or (4) ignoring the grievance altogether.
Process Flowchart & CSAT Scoring Optimization Matrix	**Interpersonal Communication Barriers**	Communication breakdowns occur due to **Semantic Barriers** (ambiguous jargon, faulty translation), **Psychological Barriers** (premature evaluation, distrust, selective perception), **Organizational Barriers** (rigid hierarchy, information filtering across multiple levels), and **Physical Barriers** (noise, channel overload) (IUC Academy).
Administrative Decision Making & Interpersonal Communication Skills	**Active Listening and Assertive Conflict Resolution**	In workplace interpersonal scenarios, the most constructive response follows **Collaborative Problem-Solving (Win-Win)**—acknowledging objective facts, separating the person from the problem, and establishing transparent performance criteria rather than passive avoidance or authoritarian coercion.
Non-Verbal / Visual Reasoning & 120-Minute CSAT Qualification Strategy	**Standard vs. Non-Standard Dice Rules**	A **Standard Dice** has opposite faces summing to **7** (**1 opposite 6** , **2 opposite 5** , **3 opposite 4**), meaning no two adjacent visible faces sum to 7. In a **General Dice** (where two adjacent faces sum to 7): if two views share **one common face**, rotate clockwise from the common face in both views to pair opposite faces; if two views share **two common faces**, the remaining third faces in both views are strictly opposite each other.
Process Flowchart & CSAT Scoring Optimization Matrix	**Triangle with n internal vertex-to-base lines**	Total triangles = **1 + 2 + ... + n = n * (n + 1) / 2** ; if divided by **m** horizontal lines as well, multiply by **m** .
Administrative Decision Making & Interpersonal Communication Skills	**Squares in an m * n grid (m <= n)**	* *Total squares* = ***(m*** n) + (m - 1)(*n* - 1) + (*m* - 2)(n - 2) + ... until one term reaches 1; for a symmetric **n *n*** *grid, Total squares* = ***n*** (n + 1) * (2n + 1) / 6.

Core Sub-Domain	Key Concept / Provision	Verified Analytical Parameters & Exam Distinctions (UPSC Official Portal)
Non-Verbal / Visual Reasoning & 120-Minute CSAT Qualification Strategy	**Rectangles (including squares) in an `m * n` grid**	** Total rectangles =* **`(m` (m + 1) / 2) (*n* (n + 1) / 2)**; for an **`n n`** *grid, Total rectangles =* **`(n` (n + 1) / 2)^2**.
Process Flowchart & CSAT Scoring Optimization Matrix	**UPSC CSAT Qualifying Mathematics (`66.67 Marks` Rule)**	Paper-II (CSAT) carries **80 questions for 200 marks** (**`+2.5 marks`** per correct answer, **`-0.833 marks`** or **`1/3rd`** negative marking per wrong answer), requiring **33% (`66.67 marks`, i.e., 27 net correct questions)** to qualify.
Administrative Decision Making & Interpersonal Communication Skills	**Three-Iteration 120-Minute Time Allocation Blueprint**	Attempt **52 to 58 high-confidence questions** across three structured passes: Pass 1 (Minutes 1–45) targets ~22 short Reading Comprehension passages and high-certainty Reasoning puzzles; Pass 2 (Minutes 46–95) targets ~20 Number System, Percentage, Permutation, and Data Sufficiency questions; Pass 3 (Minutes 96–120) targets 10–14 moderate multi-variable problems and OMR verification (IUC Academy).

Chapter *8* Multi-Statement Exam Verification Drills

Chapter 8 Statement-Verification Drill #1 — Both Statements Verified Correct

Statement-I (Constitutional and Ethical Framework for Decision Making): In administrative caselets involving public grievances, disaster relief, or resource allocation, the optimal course of action always upholds **Rule of Law**, **Procedural Fairness (Natural Justice)**, **Proportionality**, **Empathy toward Vulnerable Citizens**, and **Institutional Accountability**, without bypassing statutory verification (UPSC Syllabus Portal).

Statement-II (Eliminating Extreme Administrative Responses): Immediately reject courses of action that involve: (1) summary dismissal/suspension of subordinates without preliminary inquiry, (2) buck-passing or transferring the problem to another department without taking immediate interim relief measures, (3) yielding to unlawful mob pressure, or (4) ignoring the grievance altogether.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 8 Statement-Verification Drill #2 — Both Statements Verified Correct

Statement-I (Interpersonal Communication Barriers): Communication breakdowns occur due to **Semantic Barriers** (ambiguous jargon, faulty translation), **Psychological Barriers** (premature evaluation, distrust, selective perception), **Organizational Barriers** (rigid hierarchy, information filtering across multiple levels), and **Physical Barriers** (noise, channel overload) (IUC Academy).

Statement-II (Active Listening and Assertive Conflict Resolution): In workplace interpersonal scenarios, the most constructive response follows **Collaborative Problem-Solving (Win-Win)**—acknowledging objective facts, separating the person from the problem, and establishing transparent performance criteria rather than passive avoidance or authoritarian coercion.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 8 Statement-Verification Drill #3 — Both Statements Verified Correct

Statement-I (Standard vs. Non-Standard Dice Rules): A **Standard Dice** has opposite faces summing to `7` (`1 opposite 6`, `2 opposite 5`, `3 opposite 4`), meaning no two adjacent visible faces sum to 7. In a **General Dice** (where two adjacent faces sum to 7): if two views share **one common face**, rotate clockwise from the common face in both views to pair opposite faces; if two views share **two common faces**, the remaining third faces in both views are strictly opposite each other.

Statement-II (Triangle with `n` internal vertex-to-base lines): Total triangles = `1 + 2 + ... + n = n * (n + 1) / 2`; if divided by `m` horizontal lines as well, multiply by `m`.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 8 Statement-Verification Drill #4 — Both Statements Verified Correct

Statement-I (Squares in an `m * n` grid (`m <= n`)): * *Total squares* = `(m` n) + (m - 1)(*n* - 1) + (*m* - 2)(n - 2) + ... until one term reaches 1; for a symmetric `n n` *grid*, *Total squares* = `n` (n + 1) * (2n + 1) / 6.

Statement-II (Rectangles (including squares) in an `m * n` grid): * *Total rectangles* = `(m` (m + 1) / 2) (*n* (n + 1) / 2); for an `n n` *grid*, *Total rectangles* = `(n` (n + 1) / 2)^2.

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Chapter 8 Statement-Verification Drill #5 — Both Statements Verified Correct

Statement-I (UPSC CSAT Qualifying Mathematics (`66.67 Marks` Rule)): Paper-II (CSAT) carries **80 questions for 200 marks** (`+2.5 marks` per correct answer, `-0.833 marks` or `1/3rd` negative marking per wrong answer), requiring **33% (`66.67 marks`, i.e., 27 net correct questions)** to qualify.

Statement-II (Three-Iteration 120-Minute Time Allocation Blueprint): Attempt **52 to 58 high-confidence questions** across three structured passes: Pass 1 (Minutes 1–45) targets ~22 short Reading Comprehension passages and high-certainty Reasoning puzzles; Pass 2 (Minutes 46–95) targets ~20 Number System, Percentage, Permutation, and Data Sufficiency questions; Pass 3 (Minutes 96–120) targets 10–14 moderate multi-variable problems and OMR verification (IUC Academy).

✓ **Exam Verification Key: Both Statement-I and Statement-II are factually accurate as per UPSC Official Portal & IUC Academy.**

Solved Exam Practice Questions (MCQs)

Practice Question #1 — Solved Exam MCQ

1. **What is the remainder when `2^100` is divided by `101`?**
(A) 1
(B) 2
(C) 99
(D) 100
Correct Answer: (A)
Detailed Solution: Since `101` is a prime number and `2` is coprime to `101`, by Fermat's Little Theorem (`a^(p-1) / p` leaves remainder `1`), `2^(101-1) = 2^100` divided by `101` leaves a remainder of exactly `1` (NCERT Portal).

Practice Question #2 Solved Exam MCQ

2. **How many trailing zeros are present at the end of the product `125!` (125 factorial)?**
(A) 28
(B) 30
(C) 31
(D) 32
Correct Answer: (C)
Detailed Solution: Using Legendre's formula for highest power of 5: `floor(125/5) + floor(125/25) + floor(125/125) = 25 + 5 + 1 = 31` trailing zeros.

Practice Question #3 Solved Exam MCQ

3. **Find the unit digit of the expression `(247)^83 (638)^54 (514)^29`.**
(A) 2
(B) 4
(C) 6
(D) 8
Correct Answer: (D)
Detailed Solution: Unit digit of `7^83`: `83 mod 4 = 3`, and `7^3 = 343` (unit digit `3`). Unit digit of `8^54`: `54 mod 4 = 2`, and `8^2 = 64` (unit digit `4`). Unit digit of `4^29`: odd power of 4 gives unit digit `4`. Product of unit digits = `3 4 4 = 48`, so the unit digit is `8`.

Practice Question #4 Solved Exam MCQ

4. **If the 7-digit number `64x29y6` (where `x > y`) is completely divisible by `72`, what is the value of `(2x - y)`?**
(A) 3
(B) 6
(C) 9
(D) 12
Correct Answer: (C)
Detailed Solution: Divisibility by `72` requires divisibility by both `8` and `9`. For `8`, the last three digits `9y6` must be divisible by 8, which holds for `y = 3` (`936 / 8 = 117`) or `y = 7` (`976 / 8 = 122`). For `y = 3`, the sum of digits is `6+4+x+2+9+3+6 = 30 + x`, so `x = 6` (`6 > 3` satisfies `x > y`). For `y = 7`, the sum is `34 + x`, giving `x = 2` (which fails `x > y`). Thus `x = 6, y = 3`, and `2x - y = 2(6) - 3 = 9`.

Practice Question #5 Solved Exam MCQ

5. **How many positive factors does the number `N = 720` possess?**
(A) 24
(B) 30
(C) 32
(D) 36
Correct Answer: (B)
Detailed Solution: Prime factorizing `720 = 16 9 5 = (2^4) (3^2) (5^1)`. Total positive factors = `(4 + 1) (2 + 1) (1 + 1) = 5 3 2 = 30` (IUC Academy).

Practice Question #6 Solved Exam MCQ

6. **When a positive integer `n` is divided by `14`, the remainder is `9`. What is the remainder when `(3n + 5)` is divided by `7`?**
(A) 0
(B) 2
(C) 4
(D) 6
Correct Answer: (C)
Detailed Solution: Since `14` is a multiple of `7`, we can substitute `n = 9`. Then `3n + 5 = 3(9) + 5 = 32`. Dividing `32` by `7` gives `32 = 7 * 4 + 4`, so the remainder is `4`.

Practice Question #7 Solved Exam MCQ

7. **If the price of cooking oil rises by `25%`, by what percentage must a household reduce its consumption so that total monthly expenditure increases by only `5%`?**
(A) 12%
(B) 15%
(C) 16%
(D) 20%
Correct Answer: (C)
Detailed Solution: Let initial Price = `100` and Consumption = `100`, so Expenditure = `10000`. New Price = `125` and target Expenditure = `10500`. New Consumption = `10500 / 125 = 84`. Percentage reduction = `100 - 84 = 16%`.

Practice Question #8 Solved Exam MCQ

8. **A shopkeeper marks his goods `40%` above the cost price and allows a discount of `15%`. What is his net profit percentage?**
(A) 19%
(B) 21%
(C) 22.5%
(D) 25%
Correct Answer: (A)
Detailed Solution: Applying the successive percentage formula `x + y + (xy)/100 = 40 - 15 - (40 15) / 100 = 25 - 6 = 19%` profit.

Practice Question #9 Solved Exam MCQ

9. **The difference between Compound Interest and Simple Interest on a certain sum at `10%` per annum for `3 years` is `Rs. 930`. What is the Principal sum?**
(A) Rs. 25,000
(B) Rs. 28,000
(C) Rs. 30,000
(D) Rs. 32,000
Correct Answer: (C)
Detailed Solution: Using the 3-year difference formula `CI - SI = P (R/100)^2 (3 + R/100)`, we get `930 = P (1/100) (3.1) = P * 0.031`. Therefore, `P = 930 / 0.031 = Rs. 30,000`.

Practice Question #10 Solved Exam MCQ

10. **A vessel contains 80 liters of pure milk. 8 liters of milk are drawn out and replaced with water, and this operation is repeated two more times (total 3 times). How much pure milk remains in the vessel?**
(A) 56.40 liters
(B) 58.32 liters
(C) 60.48 liters
(D) 64.00 liters
Correct Answer: (B)
Detailed Solution: Using the replacement formula **Final Milk = V (1 - x/V)^n = 80 (1 - 8/80)^3 = 80 (0.9)^3 = 80 0.729 = 58.32 liters**.

Practice Question #11 Solved Exam MCQ

11. **A can complete a piece of work in 15 days and B in 20 days. They work together for 4 days and then A leaves. In how many days will B finish the remaining work?**
(A) 8 days
(B) 9 days
(C) 10.67 days
(D) 12 days
Correct Answer: (C)
Detailed Solution: Let **Total Work = LCM(15, 20) = 60 units**. Efficiency of A = **4 units/day**, B = **3 units/day**. In 4 days together, they complete **4 * (4 + 3) = 28 units**. Remaining work = **60 - 28 = 32 units**. Time taken by B alone = **32 / 3 = 10.67 days**.

Practice Question #12 Solved Exam MCQ

12. **A train 180 meters long passes a man running at 6 km/hr in the same direction in 12 seconds. What is the speed of the train in km/hr?**
(A) 48 km/hr
(B) 54 km/hr
(C) 60 km/hr
(D) 66 km/hr
Correct Answer: (C)
Detailed Solution: Relative speed in **m/s = 180 / 12 = 15 m/s**. Converting to **km/hr**: **15 * (18 / 5) = 54 km/hr**. Since both move in the same direction, **Speed_Train - 6 = 54**, so **Speed_Train = 60 km/hr**.

Practice Question #13 Solved Exam MCQ

13. **In how many distinct ways can the letters of the word DIRECTOR be arranged such that all three vowels (I, E, O) always stay together?**
(A) 1,080
(B) 2,160
(C) 4,320
(D) 8,640
Correct Answer: (B)
Detailed Solution: Treat **(I, E, O)** as 1 single block alongside the 5 consonants **D, R, C, T, R** (where **R** repeats twice). Total units = **6**, arranged in **6! / 2! = 720 / 2 = 360** ways. The 3 distinct vowels arrange internally in **3! = 6** ways. Total arrangements = **360 * 6 = 2,160**.

Practice Question #14 Solved Exam MCQ

14. **A committee of 5 members is to be formed from 6 men and 4 women such that it contains at least 2 women. In how many ways can this committee be selected?**
(A) 180
(B) 186
(C) 192
(D) 210
Correct Answer: (B)
Detailed Solution: Total ways with >= 2 women = (2W, 3M) + (3W, 2M) + (4W, 1M) = (4C2 6C3) + (4C3 6C2) + (4C4 6C1) = (6 20) + (4 15) + (1 6) = 120 + 60 + 6 = 186 ways (NCERT Textbooks).

Practice Question #15 Solved Exam MCQ

15. **Two fair six-sided dice are rolled simultaneously. What is the probability that the sum of the numbers on the top faces is divisible by 3?**
(A) 7/36
(B) 11/36
(C) 1/3
(D) 13/36
Correct Answer: (C)
Detailed Solution: Sums divisible by 3 are 3 (2 outcomes: (1,2),(2,1)), 6 (5 outcomes: (1,5),(2,4),(3,3),(4,2),(5,1)), 9 (4 outcomes: (3,6),(4,5),(5,4),(6,3)), and 12 (1 outcome: (6,6)). Total favorable outcomes = 2 + 5 + 4 + 1 = 12 out of 36 total outcomes, giving P = 12 / 36 = 1/3.

Practice Question #16 Solved Exam MCQ

16. **In a group of 100 candidates, 65 read English newspapers, 45 read Hindi newspapers, and 15 read neither. How many candidates read ONLY English newspapers?**
(A) 25
(B) 35
(C) 40
(D) 50
Correct Answer: (C)
Detailed Solution: Candidates reading at least one newspaper = 100 - 15 = 85. Using n(E U H) = n(E) + n(H) - n(E int H), we get 85 = 65 + 45 - Both, so Both = 110 - 85 = 25. Therefore, Only English = 65 - 25 = 40.

Practice Question #17 Solved Exam MCQ

17. **Statements: All rivers are lakes. Only a few lakes are oceans. No ocean is a desert. Conclusions: I. Some lakes are not deserts. II. All rivers being oceans is a possibility. Which conclusions logically follow?**
(A) Only I follows
(B) Only II follows
(C) Both I and II follow
(D) Neither I nor II follows
Correct Answer: (C)
Detailed Solution: Since some lakes are oceans and no ocean is a desert, the portion of lakes that is inside oceans can never be deserts (Conclusion I is definitely true). Since there is no negative restriction between rivers and oceans, all rivers can lie inside the ocean portion of lakes (Conclusion II is true).

Practice Question #18 Solved Exam MCQ

18. **Pointing to a photograph of a boy, Rohit said, "He is the only son of the mother of my mother's brother." How is Rohit related to the boy in the photograph?**
(A) Brother
(B) Nephew
(C) Uncle
(D) Cousin
Correct Answer: (B)
Detailed Solution: "My mother's brother" is Rohit's maternal uncle. The "mother of my mother's brother" is Rohit's maternal grandmother. Her "only son" is Rohit's maternal uncle himself. Therefore, Rohit is the **Nephew** of the boy in the photograph.

Practice Question #19 Solved Exam MCQ

19. **A person walks 8 km North, turns right and walks 6 km, turns right again and walks 16 km, and finally turns left and walks 9 km. How far is he from his starting point?**
(A) 15 km
(B) 17 km
(C) 19 km
(D) 21 km
Correct Answer: (B)
Detailed Solution: Net North-South displacement = 8 km North - 16 km South = 8 km South. Net East-West displacement = 6 km East + 9 km East = 15 km East. Shortest distance = sqrt(8^2 + 15^2) = sqrt(64 + 225) = sqrt(289) = 17 km.

Practice Question #20 Solved Exam MCQ

20. **In a certain code language, MADRAS is coded as 112 and DELHI is coded as 76. How will LUCKNOW be coded in that language?**
(A) 182
(B) 190
(C) 198
(D) 204
Correct Answer: (C)
Detailed Solution: Sum of alphabetical positions of MADRAS = 13+1+4+18+1+19 = 56, and 56 2 = 112. *Sum of* DELHI = 4+5+12+8+9 = 38, *and* 38 2 = 76. Sum of LUCKNOW = 12+21+3+11+14+15+23 = 99, and 99 * 2 = 198.

Practice Question #21 Solved Exam MCQ

21. **Six persons P, Q, R, S, T, U sit at a circular table facing the center. P sits second to the right of T. Q sits immediate right of T and opposite to S. R does not sit adjacent to T. Who sits opposite to P?**
(A) Q
(B) R
(C) T
(D) U
Correct Answer: (D)
Detailed Solution: Numbering the 6 seats 1 to 6 anticlockwise (towards the right when facing the center) with T at Seat 1: Q is at Seat 2 (immediate right of T), P is at Seat 3 (second to the right of T), and S sits opposite Q(2) at Seat 5. Since R is not adjacent to T(1), R cannot be at Seat 6 and must occupy Seat 4, leaving U at Seat 6 directly opposite P(3).

Practice Question #22 Solved Exam MCQ

22. **What is the exact angle between the hour hand and the minute hand of a clock at 7:24 PM?**
(A) 74 degrees
(B) 78 degrees
(C) 82 degrees
(D) 84 degrees
Correct Answer: (B)
Detailed Solution: Using $\text{Angle} = |30H - 5.5M|$, we substitute $H = 7$ and $M = 24$: $\text{Angle} = |30(7) - 5.5(24)| = |210 - 132| = 78$ degrees.

Practice Question #23 Solved Exam MCQ

23. **If 15th August 2026 falls on a Saturday, on which day of the week did 15th August 1947 fall?**
(A) Thursday
(B) Friday
(C) Saturday
(D) Sunday
Correct Answer: (B)
Detailed Solution: Between 15 Aug 1947 and 15 Aug 2026 there are 79 years, containing 20 leap years (1948, 1952, ..., 2024) and 59 ordinary years. Total odd days = $59(1) + 20(2) = 99$ odd days. Since $99 \bmod 7 = 1$, moving backward 1 day from Saturday gives **Friday** (UPSC Portal).

Practice Question #24 Solved Exam MCQ

24. **A solid wooden cube is painted blue on all six faces and cut into 125 identical smaller cubes. How many smaller cubes have AT LEAST TWO faces painted?**
(A) 36
(B) 44
(C) 48
(D) 52
Correct Answer: (B)
Detailed Solution: Here $n^3 = 125$, so $n = 5$. Cubes with at least two faces painted = (2-face edge cubes) + (3-face corner cubes) = $12(n - 2) + 8 = 12(5 - 2) + 8 = 36 + 8 = 44$.

Practice Question #25 Solved Exam MCQ

25. **Passage: "Subsidizing chemical fertilizers without soil-health conditionalities has distorted the nitrogen-phosphorus-potassium ratio across Indian farmlands, degrading soil organic carbon while inflating fiscal deficits." Which is the most valid assumption behind this statement?**
(A) Chemical fertilizers should be completely banned in India.
(B) Farmers respond to input pricing signals when choosing fertilizer quantities.
(C) Organic farming cannot feed India's growing population.
(D) Fiscal deficits are caused solely by agricultural subsidies.
Correct Answer: (B)
Detailed Solution: Options (A), (C), and (D) use extreme or out-of-scope claims (completely banned, solely). The author links unconditional subsidies to distorted fertilizer usage, assuming that pricing/subsidy structures directly influence farmers' application choices.

Practice Question #26 Solved Exam MCQ

26. **Passage:**
"Urban flood resilience depends less on expanding concrete stormwater drains and more on restoring peri-urban wetlands that act as natural sponges during high-intensity cloudbursts." What is the central crux of the passage?
(A) Concrete stormwater drains should be demolished in all cities.
(B) Ecological infrastructure is vital for mitigating extreme urban flooding.
(C) Cloudbursts occur only in cities that destroy their wetlands.
(D) Urbanization must be halted to prevent climate change.
Correct Answer: (B)
Detailed Solution: The passage contrasts hard engineering alone with ecological restoration of peri-urban wetlands as natural sponges, making (B) the precise synthesis of the author's central thesis (IUC Academy).

Practice Question #27 Solved Exam MCQ

27. **In a pie chart of a state's Rs. 7,200 Crore budget, Education accounts for 75 degrees and Healthcare accounts for 55 degrees. By how many Crores does the Education allocation exceed the Healthcare allocation?**
(A) Rs. 350 Crore
(B) Rs. 400 Crore
(C) Rs. 450 Crore
(D) Rs. 500 Crore
Correct Answer: (B)
Detailed Solution: Angular difference = 75 - 55 = 20 degrees. Difference in value = (20 / 360) 7200 = (1 / 18) 7200 = Rs. 400 Crore.

Practice Question #28 Solved Exam MCQ

28. **Question: "Is positive integer x divisible by 6?" Statement-I: x is the product of three consecutive positive integers. Statement-II: x is divisible by 3. Which option is correct?**
(A) Statement-I alone is sufficient, but Statement-II alone is not.
(B) Statement-II alone is sufficient, but Statement-I alone is not.
(C) Both Statement-I and Statement-II together are required.
(D) Either Statement-I alone or Statement-II alone is sufficient.
Correct Answer: (A)
Detailed Solution: The product of any three consecutive positive integers $k(k+1)(k+2)$ is always divisible by $3! = 6$ (Definite Yes), so Statement-I alone is sufficient. Statement-II allows $x = 9$ (No) or $x = 12$ (Yes), so Statement-II alone is insufficient.

Practice Question #29 Solved Exam MCQ

29. **Question: "What is the two-digit number N?" Statement-I: The difference between the two digits of N is 5. Statement-II: The sum of the digits of N equals 9, and the tens digit is larger than the units digit. Which option is correct?**
(A) Statement-I alone is sufficient.
(B) Statement-II alone is sufficient.
(C) Both Statement-I and Statement-II together are necessary.
(D) Even both statements together are insufficient.
Correct Answer: (C)
Detailed Solution: Statement-I alone gives 61, 16, 72, 27, 83, 38, 94, 49. Statement-II alone gives 90, 81, 72, 63, 54. Combining both ($x - y = 5$ and $x + y = 9$ with $x > y$) uniquely yields $x = 7, y = 2$, so $N = 72$.

Practice Question #30 Solved Exam MCQ

30. **Find the missing number in the series:** `7, 15, 32, 67, 138, ?`
(A) 279
(B) 281
(C) 283
(D) 285
Correct Answer: (B)
Detailed Solution: The pattern follows `2 + 1`, 2 + 2, `2 + 3`, 2 + 4, `2 + 5`: `7` 2+1=15, `152+2=32`, `32` 2+3=67, `672+4=138`, *and* `138` 2+5 = 276 + 5 = 281.

Practice Question #31 Solved Exam MCQ

31. **How many squares of all sizes exist inside a standard `4 * 4` square grid?**
(A) 16
(B) 24
(C) 30
(D) 36
Correct Answer: (C)
Detailed Solution: Using the sum of squares formula `n(n+1)(2n+1)/6` for `n = 4`:
`1^2 + 2^2 + 3^2 + 4^2 = 1 + 4 + 9 + 16 = 30` squares.

Practice Question #32 Solved Exam MCQ

32. **In a row of students facing North, Rahul is `14th from the left end` and Priya is `19th from the right end`. When they interchange their positions, Rahul becomes `23rd from the left end`. What is the total number of students in the row?**
(A) 40
(B) 41
(C) 42
(D) 43
Correct Answer: (B)
Detailed Solution: After interchange, Rahul occupies Priya's original seat, which is `23rd from the left` and `19th from the right`. Total students = `Left + Right - 1 = 23 + 19 - 1 = 41`.

Practice Question #33 Solved Exam MCQ

33. **The average weight of `24 students` in a section is `52 kg`. When the class teacher's weight is included, the average increases by `1.2 kg`. What is the weight of the class teacher?**
(A) 78 kg
(B) 80 kg
(C) 82 kg
(D) 84 kg
Correct Answer: (C)
Detailed Solution: `Teacher's Weight = Old Average + (New Total Members *Increase in Average*) = 52 + (25 1.2) = 52 + 30 = 82 kg`.

Practice Question #34 Solved Exam MCQ

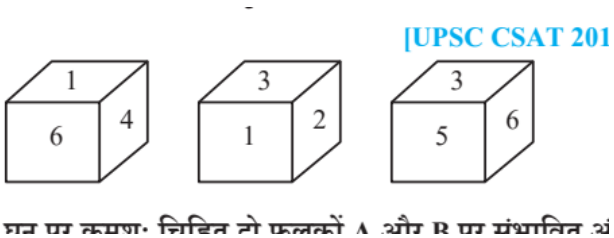
34. **Two pipes A and B can fill a cistern in 24 minutes and 32 minutes respectively. Both pipes are opened together, but after how many minutes should Pipe B be closed so that the cistern is completely full in 18 minutes?**
(A) 6 minutes
(B) 8 minutes
(C) 10 minutes
(D) 12 minutes
Correct Answer: (B)
Detailed Solution: Let capacity = **LCM(24, 32) = 96 units**. Efficiency of A = **4 units/min**, B = **3 units/min**. Pipe A runs for all **18 minutes**, filling **18 * 4 = 72 units**. The remaining **96 - 72 = 24 units** were filled by Pipe B in **24 / 3 = 8 minutes**.

Practice Question #35 Solved Exam MCQ

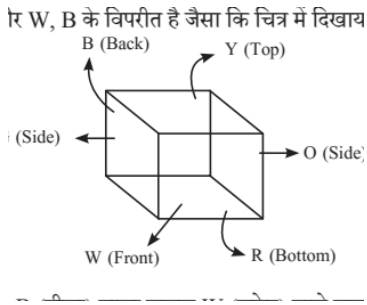
35. **A candidate in UPSC CSAT attempts 54 questions and gets 42 correct and 12 wrong. What is the candidate's exact net score out of 200?**
(A) 92.50
(B) 95.00
(C) 96.67
(D) 97.50
Correct Answer: (B)
Detailed Solution: Each correct answer carries **+2.5 marks** (**42 2.5 = 105.0 *marks***), *and every 3 wrong answers deduct* **2.5 *marks*** (**12** (2.5 / 3) = 10.0 marks). Net Score = **105.0 - 10.0 = 95.00 marks** (UPSC Portal).

Visual Analytical, Non-Verbal & Spatial Reasoning Diagram Gallery (UPSC CSAT)

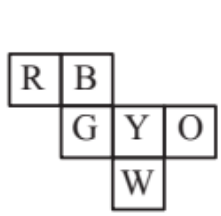
CSAT Analytical & Spatial Figure #1



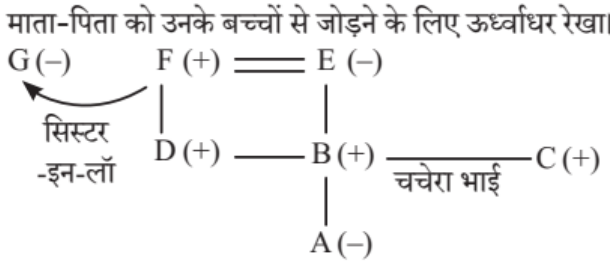
CSAT Analytical & Spatial Figure #2



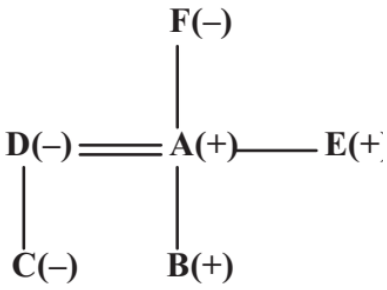
CSAT Analytical & Spatial Figure #3



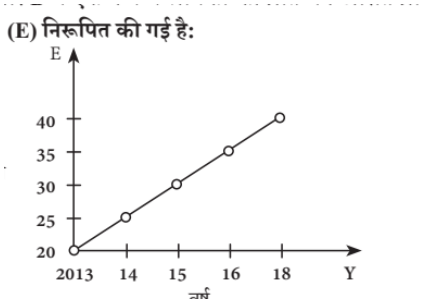
CSAT Analytical & Spatial Figure #4



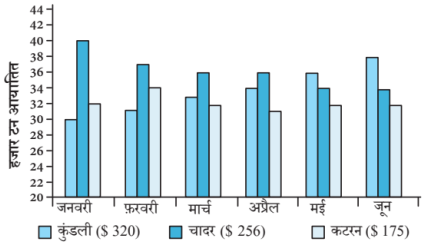
CSAT Analytical & Spatial Figure #5



CSAT Analytical & Spatial Figure #6

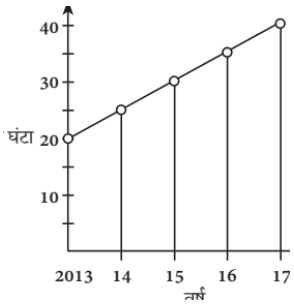


CSAT Analytical & Spatial Figure #7



कोष्ठक में दिए गए आँकड़े छः माह की अवधि के दौरान प्रति टन औसत लागत

CSAT Analytical & Spatial Figure #8



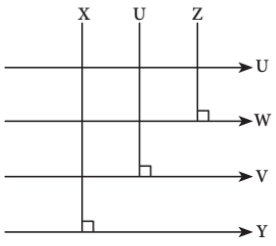
CSAT Analytical & Spatial Figure #9

प्रश्न 3. निम्नलिखित सारणी पर विचार कीजिए :

खिलाड़ी	पहली पारी में बनाए गए रन	पहली पारी में खेली गई गेंदें	दूसरी पारी में बनाए गए रन	दूसरी पारी में खेली गई गेंदें
A	61	99	14	76
B	05	12	50	85
C	15	75	20	50
D	13	55	12	50

इस टेस्ट मैच में, सबसे तेज़ रन बनाने वाला कौन है?

CSAT Analytical & Spatial Figure #10

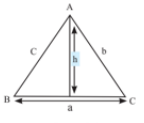


CSAT Analytical & Spatial Figure #11

इसलिए, विकल्प (b) सही है।

विभिन्न आकृतियों के लिए क्षेत्रफल और परिमाप

त्रिभुज



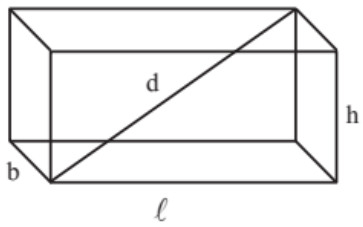
- वृत्त के चतुर्थांश का क्षेत्रफल = $\frac{\pi r^2}{4}$

विभिन्न आकृतियों के लिए सतह का क्षेत्रफल और आयतन

घनाभ

एक घनाभ में छह आयताकार फलक, बारह किनारे और आठ शीर्ष होते हैं। एक घनाभ में सभी कोण समकोण होते हैं और विपरीत फलक सर्वांगसम (समान आकार और आकृति वाले) होते हैं। **उदाहरण:** माचिस की डिब्बी, ईंट, किताब आदि सभी घनाभ के उदाहरण हैं।

CSAT Analytical & Spatial Figure #12

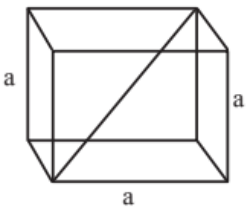


CSAT Analytical & Spatial Figure #13

ार सभी फलक सर्वांगसम (एक

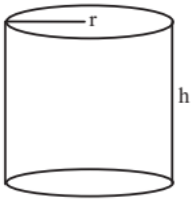
ोष

ाभी



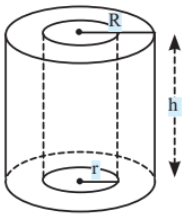
CSAT Analytical & Spatial Figure #14

$= \pi r^2 \times h = \pi r^2 h$



ल = आधार की परिधि × ऊँचाई

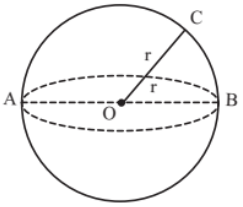
CSAT Analytical & Spatial Figure #15



ा = R. अंतःत्रिज्या = r और ऊँचाई =

CSAT Analytical & Spatial Figure #16

दूरी इसकी त्रिज्या कहलाती है।



े की त्रिज्या को

Extended Comparative & Analytical Practice Set (Questions *36* to *75*)

Practice Question #36 — High-Yield Comparative MCQ

Q36. With reference to Divisibility Divisor and Operational Verification Rule, which of the following is accurately matched with "Divisor 3 and 9"?

(A) Sum of all digits must be divisible by 3 or 9 respectively

(B) Last 2 digits divisible by 4; last 3 digits divisible by 8

(C) Difference between 3-digit triplets from right to left divisible by 7, 11, or 13

(D) Difference between sum of odd-place digits and even-place digits is 0 or multiple of 11

Correct Answer: (A) | **Explanation:** For **Divisor 3 and 9** (Divisibility Divisor), the verified Operational Verification Rule is **Sum of all digits must be divisible by 3 or 9 respectively**. Furthermore, Remainder of `N / 9` equals digital root of `N`. (Source: UPSC Official Portal & IUC Academy).

Practice Question #37 — High-Yield Comparative MCQ

Q37. With reference to Divisibility Divisor and Operational Verification Rule, which of the following is accurately matched with "Divisor 4 and 8"?

(A) Difference between 3-digit triplets from right to left divisible by 7, 11, or 13

(B) Last 2 digits divisible by 4; last 3 digits divisible by 8

(C) Difference between sum of odd-place digits and even-place digits is 0 or multiple of 11

(D) Always divisible by `(a + b)` when exponent `n` is an odd positive integer

Correct Answer: (B) | **Explanation:** For **Divisor 4 and 8** (Divisibility Divisor), the verified Operational Verification Rule is **Last 2 digits divisible by 4; last 3 digits divisible by 8**. Furthermore, Remainder equals `Last 2 digits / 4` or `Last 3 digits / 8`. (Source: UPSC Official Portal & IUC Academy).

Practice Question #38 High-Yield Comparative MCQ

Q38. With reference to Divisibility Divisor and Operational Verification Rule, which of the following is accurately matched with "Divisor 7, 11, 13"?

(A) Difference between sum of odd-place digits and even-place digits is 0 or multiple of 11

(B) Always divisible by `(a + b)` when exponent `n` is an odd positive integer

(C) Difference between 3-digit triplets from right to left divisible by 7, 11, or 13

(D) `CP / MP = (100 - D%) / (100 + P%)`

Correct Answer: (C) | **Explanation:** For **Divisor 7, 11, 13** (Divisibility Divisor), the verified Operational Verification Rule is **Difference between 3-digit triplets from right to left divisible by 7, 11, or 13**. Furthermore, `1001 = 7 11 13` divides any 6-digit `abcabc` number. (Source: UPSC Official Portal & IUC Academy).

Practice Question #39 High-Yield Comparative MCQ

Q39. With reference to Divisibility Divisor and Operational Verification Rule, which of the following is accurately matched with "Divisor 11 Specific"?

(A) Always divisible by `(a + b)` when exponent `n` is an odd positive integer

(B) `CP / MP = (100 - D%) / (100 + P%)`

(C) `Gap_3yr / Gap_2yr = (300 + R) / 100`

(D) Difference between sum of odd-place digits and even-place digits is 0 or multiple of 11

Correct Answer: (D) | **Explanation:** For **Divisor 11 Specific** (Divisibility Divisor), the verified Operational Verification Rule is **Difference between sum of odd-place digits and even-place digits is 0 or multiple of 11**. Furthermore, Alternating sign sum from right to left gives remainder. (Source: UPSC Official Portal & IUC Academy).

Practice Question #40 High-Yield Comparative MCQ

Q40. With reference to Divisibility Divisor and Operational Verification Rule, which of the following is accurately matched with "Binomial `(a^n + b^n)`"?

(A) Always divisible by `(a + b)` when exponent `n` is an odd positive integer

(B) `CP / MP = (100 - D%) / (100 + P%)`

(C) `Gap_3yr / Gap_2yr = (300 + R) / 100`

(D) `Initial_Vol *Solute*_1% = *Final_Vol* Solute_2%`

Correct Answer: (A) | **Explanation:** For **Binomial** `(a^n + b^n)` (Divisibility Divisor), the verified Operational Verification Rule is **Always divisible by** `(a + b)` **when exponent** `n` **is an odd positive integer**. Furthermore, Never divisible by `(a - b)` for general positive integers. (Source: UPSC Official Portal & IUC Academy).

Practice Question #41 High-Yield Comparative MCQ

Q41. With reference to Quantitative Sub-Topic and Core Governing Equation, which of the following is accurately matched with "Markup & Discount"?

(A) `Gap_3yr / Gap_2yr = (300 + R) / 100`

(B) `CP / MP = (100 - D%) / (100 + P%)`

(C) `Initial_Vol *Solute*_1% = *Final_Vol* Solute_2%`

(D) `Speed_Boat = (Downstream + Upstream) / 2`

Correct Answer: (B) | **Explanation:** For **Markup & Discount** (Quantitative Sub-Topic), the verified Core Governing Equation is `CP / MP = (100 - D%) / (100 + P%)`. Furthermore, Selling Price (`SP`) bridges `CP` and `MP`. (Source: UPSC Official Portal & IUC Academy).

Practice Question #42 High-Yield Comparative MCQ

Q42. With reference to Quantitative Sub-Topic and Core Governing Equation, which of the following is accurately matched with "2-Year vs. 3-Year CI-SI Gap"?

(A) **Initial_Vol *Solute*_1% = *Final_Vol* Solute_2%**
(B) **Speed_Boat = (Downstream + Upstream) / 2**
(C) **Gap_3yr / Gap_2yr = (300 + R) / 100**
(D) **Time = (Length_Train + Length_Bridge) / Speed**

Correct Answer: (C) | **Explanation:** For **2-Year vs. 3-Year CI-SI Gap** (Quantitative Sub-Topic), the verified Core Governing Equation is **Gap_3yr / Gap_2yr = (300 + R) / 100**. Furthermore, Principal **P** and annual rate **R%**. (Source: UPSC Official Portal & IUC Academy).

Practice Question #43 High-Yield Comparative MCQ

Q43. With reference to Quantitative Sub-Topic and Core Governing Equation, which of the following is accurately matched with "Solution Concentration"?

(A) **Speed_Boat = (Downstream + Upstream) / 2**
(B) **Time = (Length_Train + Length_Bridge) / Speed**
(C) Selection of 1 or more items from **n** distinct items
(D) **Initial_Vol *Solute*_1% = *Final_Vol* Solute_2%**

Correct Answer: (D) | **Explanation:** For **Solution Concentration** (Quantitative Sub-Topic), the verified Core Governing Equation is **Initial_Vol *Solute*_1% = *Final_Vol* Solute_2%**. Furthermore, Mass of non-changing component (solute or solvent). (Source: UPSC Official Portal & IUC Academy).

Practice Question #44 High-Yield Comparative MCQ

Q44. With reference to Quantitative Sub-Topic and Core Governing Equation, which of the following is accurately matched with "Boats and Streams"?

(A) **Speed_Boat = (Downstream + Upstream) / 2**
(B) **Time = (Length_Train + Length_Bridge) / Speed**
(C) Selection of 1 or more items from **n** distinct items
(D) Every pair of **n** persons interacts once

Correct Answer: (A) | **Explanation:** For **Boats and Streams** (Quantitative Sub-Topic), the verified Core Governing Equation is **Speed_Boat = (Downstream + Upstream) / 2**. Furthermore, **Speed_Stream = (Downstream - Upstream) / 2**. (Source: UPSC Official Portal & IUC Academy).

Practice Question #45 High-Yield Comparative MCQ

Q45. With reference to Quantitative Sub-Topic and Core Governing Equation, which of the following is accurately matched with "Trains & Platforms"?

(A) Selection of 1 or more items from **n** distinct items
(B) **Time = (Length_Train + Length_Bridge) / Speed**
(C) Every pair of **n** persons interacts once
(D) Joining non-adjacent vertices of an **n**-sided polygon

Correct Answer: (B) | **Explanation:** For **Trains & Platforms** (Quantitative Sub-Topic), the verified Core Governing Equation is **Time = (Length_Train + Length_Bridge) / Speed**. Furthermore, Convert **km/hr** to **m/s** by multiplying by **5 / 18**. (Source: UPSC Official Portal & IUC Academy).

Practice Question #46 High-Yield Comparative MCQ

Q46. With reference to Combinatorial Scenario and Order / Distinctness Condition, which of the following is accurately matched with "Non-Empty Subsets"?

(A) Every pair of `n` persons interacts once
(B) Joining non-adjacent vertices of an `n`-sided polygon
(C) Selection of 1 or more items from `n` distinct items
(D) Zero items placed in their original assigned positions

Correct Answer: (C) | **Explanation:** For **Non-Empty Subsets** (Combinatorial Scenario), the verified Order / Distinctness Condition is **Selection of 1 or more items from `n` distinct items**. Furthermore, `(2^n) - 1`. (Source: UPSC Official Portal & IUC Academy).

Practice Question #47 High-Yield Comparative MCQ

Q47. With reference to Combinatorial Scenario and Order / Distinctness Condition, which of the following is accurately matched with "Handshakes / Chess Games"?

(A) Joining non-adjacent vertices of an `n`-sided polygon
(B) Zero items placed in their original assigned positions
(C) Posterior probability of cause `A_i` given event `B`
(D) Every pair of `n` persons interacts once

Correct Answer: (D) | **Explanation:** For **Handshakes / Chess Games** (Combinatorial Scenario), the verified Order / Distinctness Condition is **Every pair of `n` persons interacts once**. Furthermore, `nC2 = n * (n - 1) / 2`. (Source: UPSC Official Portal & IUC Academy).

Practice Question #48 High-Yield Comparative MCQ

Q48. With reference to Combinatorial Scenario and Order / Distinctness Condition, which of the following is accurately matched with "Diagonals of Polygon"?

(A) Joining non-adjacent vertices of an `n`-sided polygon
(B) Zero items placed in their original assigned positions
(C) Posterior probability of cause `A_i` given event `B`
(D) `All A are B` implies `Some A are B` and `Some B are A`

Correct Answer: (A) | **Explanation:** For **Diagonals of Polygon** (Combinatorial Scenario), the verified Order / Distinctness Condition is **Joining non-adjacent vertices of an `n`-sided polygon**. Furthermore, `nC2 - n = n * (n - 3) / 2`. (Source: UPSC Official Portal & IUC Academy).

Practice Question #49 High-Yield Comparative MCQ

Q49. With reference to Combinatorial Scenario and Order / Distinctness Condition, which of the following is accurately matched with "Derangement `D(n)`"?

(A) Posterior probability of cause `A_i` given event `B`
(B) Zero items placed in their original assigned positions
(C) `All A are B` implies `Some A are B` and `Some B are A`
(D) `Some A are not B` does not imply `Some B are not A`

Correct Answer: (B) | **Explanation:** For **Derangement** `D(n)` (Combinatorial Scenario), the verified Order / Distinctness Condition is **Zero items placed in their original assigned positions**. Furthermore, `n! * sum((-1)^k / k!)`. (Source: UPSC Official Portal & IUC Academy).

Practice Question #50 High-Yield Comparative MCQ

Q50. With reference to Combinatorial Scenario and Order / Distinctness Condition, which of the following is accurately matched with "Bayes Conditional Law"?

(A) `All A are B` implies `Some A are B` and `Some B are A`
(B) `Some A are not B` does not imply `Some B are not A`
(C) Posterior probability of cause `A_i` given event `B`
(D) Never infer gender from a person's name (`Kiran`, `Kamal`, `Suman`)

Correct Answer: (C) | **Explanation:** For **Bayes Conditional Law** (Combinatorial Scenario), the verified Order / Distinctness Condition is **Posterior probability of cause `A_i` given event `B`**. Furthermore, `P(A_i. (Source: UPSC Official Portal & IUC Academy).

Practice Question #51 High-Yield Comparative MCQ

Q51. With reference to Deductive Sub-Topic and Core Analytical Rule, which of the following is accurately matched with "Syllogism (`All + Some`)"?

(A) `Some A are not B` does not imply `Some B are not A`
(B) Never infer gender from a person's name (`Kiran`, `Kamal`, `Suman`)
(C) Morning shadow = West; Evening shadow = East
(D) `All A are B` implies `Some A are B` and `Some B are A`

Correct Answer: (D) | **Explanation:** For **Syllogism (`All + Some`)** (Deductive Sub-Topic), the verified Core Analytical Rule is `All A are B` **implies** `Some A are B` **and** `Some B are A`. Furthermore, Concluding `All B are A` from `All A are B`. (Source: UPSC Official Portal & IUC Academy).

Practice Question #52 High-Yield Comparative MCQ

Q52. With reference to Deductive Sub-Topic and Core Analytical Rule, which of the following is accurately matched with "Syllogism (`Some not`)"?

(A) `Some A are not B` does not imply `Some B are not A`
(B) Never infer gender from a person's name (`Kiran`, `Kamal`, `Suman`)
(C) Morning shadow = West; Evening shadow = East
(D) Sum of opposite alphabetical ranks is always `27`

Correct Answer: (A) | **Explanation:** For **Syllogism (`Some not`)** (Deductive Sub-Topic), the verified Core Analytical Rule is `Some A are not B` **does not imply** `Some B are not A`. Furthermore, Reversing `Some A are not B` to `Some B are not A`. (Source: UPSC Official Portal & IUC Academy).

Practice Question #53 High-Yield Comparative MCQ

Q53. With reference to Deductive Sub-Topic and Core Analytical Rule, which of the following is accurately matched with "Blood Relations"?

(A) Morning shadow = West; Evening shadow = East
(B) Never infer gender from a person's name (`Kiran`, `Kamal`, `Suman`)
(C) Sum of opposite alphabetical ranks is always `27`
(D) `Angle =

Correct Answer: (B) | **Explanation:** For **Blood Relations** (Deductive Sub-Topic), the verified Core Analytical Rule is **Never infer gender from a person's name (`Kiran`, `Kamal`, `Suman`)**. Furthermore, Assuming gender without an explicit relation keyword. (Source: UPSC Official Portal & IUC Academy).

Practice Question #54 High-Yield Comparative MCQ

Q54. With reference to Deductive Sub-Topic and Core Analytical Rule, which of the following is accurately matched with "Direction Shadows"?

(A) Sum of opposite alphabetical ranks is always `27`
(B) `Angle =
(C) Morning shadow = West; Evening shadow = East
(D) Subtract given time from `11:60` (or `23:60`)

Correct Answer: (C) | **Explanation:** For **Direction Shadows** (Deductive Sub-Topic), the verified Core Analytical Rule is **Morning shadow = West; Evening shadow = East**. Furthermore, Confusing left/right when person faces South. (Source: UPSC Official Portal & IUC Academy).

Practice Question #55 High-Yield Comparative MCQ

Q55. With reference to Deductive Sub-Topic and Core Analytical Rule, which of the following is accurately matched with "Letter Coding"?

(A) `Angle =
(B) Subtract given time from `11:60` (or `23:60`)
(C) `100 yrs = 5`, `200 yrs = 3`, `300 yrs = 1`, `400 yrs = 0`
(D) Sum of opposite alphabetical ranks is always `27`

Correct Answer: (D) | **Explanation:** For **Letter Coding** (Deductive Sub-Topic), the verified Core Analytical Rule is **Sum of opposite alphabetical ranks is always** `27`. Furthermore, Counting backward manually from `Z`. (Source: UPSC Official Portal & IUC Academy).

Practice Question #56 High-Yield Comparative MCQ

Q56. With reference to Analytical Topic and Mathematical / Logical Rule, which of the following is accurately matched with "Clock Angle Formula"?

(A) `Angle =
(B) Subtract given time from `11:60` (or `23:60`)
(C) `100 yrs = 5`, `200 yrs = 3`, `300 yrs = 1`, `400 yrs = 0`
(D) `Leap Year` repeats in `+28 yrs`; `Leap+1` in `+6 yrs`; `Leap+2/+3` in `+11 yrs`

Correct Answer: (A) | **Explanation:** For **Clock Angle Formula** (Analytical Topic), the verified Mathematical / Logical Rule is **`Angle** =. Furthermore, *30H* - 5.5M. (Source: UPSC Official Portal & IUC Academy).

Practice Question #57 High-Yield Comparative MCQ

Q57. With reference to Analytical Topic and Mathematical / Logical Rule, which of the following is accurately matched with "Mirror Time of Clock"?

(A) `100 yrs = 5`, `200 yrs = 3`, `300 yrs = 1`, `400 yrs = 0`
(B) Subtract given time from `11:60` (or `23:60`)
(C) `Leap Year` repeats in `+28 yrs`; `Leap+1` in `+6 yrs`; `Leap+2/+3` in `+11 yrs`
(D) Cube cut into `n^3` smaller cubes by `3*(n - 1)` cuts

Correct Answer: (B) | **Explanation:** For **Mirror Time of Clock** (Analytical Topic), the verified Mathematical / Logical Rule is **Subtract given time from `11:60` (or `23:60`)**. Furthermore, Horizontal mirror (`Water image`): subtract from `18:30` or `17:90`. (Source: UPSC Official Portal & IUC Academy).

Practice Question #58 High-Yield Comparative MCQ

Q58. With reference to Analytical Topic and Mathematical / Logical Rule, which of the following is accurately matched with "Century Odd Days"?

(A) `Leap Year` repeats in `+28 yrs`; `Leap+1` in `+6 yrs`; `Leap+2/+3` in `+11 yrs`
(B) Cube cut into `n^3` smaller cubes by `3*(n - 1)` cuts
(C) `100 yrs = 5`, `200 yrs = 3`, `300 yrs = 1`, `400 yrs = 0`
(D) Primary thesis for which the author wrote the passage

Correct Answer: (C) | **Explanation:** For **Century Odd Days** (Analytical Topic), the verified Mathematical / Logical Rule is `100 yrs = 5`, `200 yrs = 3`, `300 yrs = 1`, `400 yrs = 0`. Furthermore, Exact calendar cycle repeats every `400 years`. (Source: UPSC Official Portal & IUC Academy).

Practice Question #59 High-Yield Comparative MCQ

Q59. With reference to Analytical Topic and Mathematical / Logical Rule, which of the following is accurately matched with "Calendar Repetition"?

(A) Cube cut into `n^3` smaller cubes by `3*(n - 1)` cuts
(B) Primary thesis for which the author wrote the passage
(C) Unstated foundational premise behind the author's claim
(D) `Leap Year` repeats in `+28 yrs`; `Leap+1` in `+6 yrs`; `Leap+2/+3` in `+11 yrs`

Correct Answer: (D) | **Explanation:** For **Calendar Repetition** (Analytical Topic), the verified Mathematical / Logical Rule is `Leap Year` **repeats in** `+28 yrs`; `Leap+1` **in** `+6 yrs`; `Leap+2/+3` **in** `+11 yrs`. Furthermore, Governed by cumulative odd days reaching `0 (mod 7)`. (Source: UPSC Official Portal & IUC Academy).

Practice Question #60 High-Yield Comparative MCQ

Q60. With reference to Analytical Topic and Mathematical / Logical Rule, which of the following is accurately matched with "Cubes & Painted Cuts"?

(A) Cube cut into `n^3` smaller cubes by `3*(n - 1)` cuts
(B) Primary thesis for which the author wrote the passage
(C) Unstated foundational premise behind the author's claim
(D) Necessary consequence derived from stated facts

Correct Answer: (A) | **Explanation:** For **Cubes & Painted Cuts** (Analytical Topic), the verified Mathematical / Logical Rule is **Cube cut into** `n^3` **smaller cubes by** `3*(n - 1)` **cuts**. Furthermore, `3-face = 8`, `2-face = 12(n-2)`, `1-face = 6` (n-2)^2, `0-face = (n-2)^3`. (Source: UPSC Official Portal & IUC Academy).

Practice Question #61 High-Yield Comparative MCQ

Q61. With reference to Question Stem Keyword and Exact Analytical Meaning, which of the following is accurately matched with "Crux / Central Idea / Essence"?

(A) Unstated foundational premise behind the author's claim
(B) Primary thesis for which the author wrote the passage
(C) Necessary consequence derived from stated facts
(D) Immediate secondary result of the passage's main conclusion

Correct Answer: (B) | **Explanation:** For **Crux / Central Idea / Essence** (Question Stem Keyword), the verified Exact Analytical Meaning is **Primary thesis for which the author wrote the passage**. Furthermore, Covers the main conclusion across the whole passage. (Source: UPSC Official Portal & IUC Academy).

Practice Question #62 High-Yield Comparative MCQ

Q62. With reference to Question Stem Keyword and Exact Analytical Meaning, which of the following is accurately matched with "Valid Assumption"?

(A) Necessary consequence derived from stated facts
(B) Immediate secondary result of the passage's main conclusion
(C) Unstated foundational premise behind the author's claim
(D) Actionable reform aligned with the root problem identified

Correct Answer: (C) | **Explanation:** For **Valid Assumption** (Question Stem Keyword), the verified Exact Analytical Meaning is **Unstated foundational premise behind the author's claim**. Furthermore, Negating the option causes the author's argument to collapse. (Source: UPSC Official Portal & IUC Academy).

Practice Question #63 High-Yield Comparative MCQ

Q63. With reference to Question Stem Keyword and Exact Analytical Meaning, which of the following is accurately matched with "Logical Inference / Implication"?

(A) Immediate secondary result of the passage's main conclusion
(B) Actionable reform aligned with the root problem identified
(C) Yields unique answer
(D) Necessary consequence derived from stated facts

Correct Answer: (D) | **Explanation:** For **Logical Inference / Implication** (Question Stem Keyword), the verified Exact Analytical Meaning is **Necessary consequence derived from stated facts**. Furthermore, Must follow directly from the passage text alone. (Source: UPSC Official Portal & IUC Academy).

Practice Question #64 High-Yield Comparative MCQ

Q64. With reference to Question Stem Keyword and Exact Analytical Meaning, which of the following is accurately matched with "Corollary"?

(A) Immediate secondary result of the passage's main conclusion
(B) Actionable reform aligned with the root problem identified
(C) Yields unique answer
(D) Yields multiple values

Correct Answer: (A) | **Explanation:** For **Corollary** (Question Stem Keyword), the verified Exact Analytical Meaning is **Immediate secondary result of the passage's main conclusion**. Furthermore, Requires zero external premises beyond the author's conclusion. (Source: UPSC Official Portal & IUC Academy).

Practice Question #65 High-Yield Comparative MCQ

Q65. With reference to Question Stem Keyword and Exact Analytical Meaning, which of the following is accurately matched with "Practical / Policy Message"?

(A) Yields unique answer
(B) Actionable reform aligned with the root problem identified
(C) Yields multiple values
(D) Proves claim is definitely FALSE

Correct Answer: (B) | **Explanation:** For **Practical / Policy Message** (Question Stem Keyword), the verified Exact Analytical Meaning is **Actionable reform aligned with the root problem identified**. Furthermore, Addresses the exact bottleneck diagnosed by the author. (Source: UPSC Official Portal & IUC Academy).

Practice Question #66 High-Yield Comparative MCQ

Q66. With reference to Sufficiency Outcome and Condition on Statement I Alone, which of the following is accurately matched with "Statement I Alone Sufficient"?

(A) Yields multiple values
(B) Proves claim is definitely FALSE
(C) Yields unique answer
(D) 75% Accuracy

Correct Answer: (C) | **Explanation:** For **Statement I Alone Sufficient** (Sufficiency Outcome), the verified Condition on Statement I Alone is **Yields unique answer**. Furthermore, Fails to give unique answer. (Source: UPSC Official Portal & IUC Academy).

Practice Question #67 High-Yield Comparative MCQ

Q67. With reference to Sufficiency Outcome and Condition on Statement I Alone, which of the following is accurately matched with "Either Alone Sufficient"?

(A) Yields multiple values
(B) Proves claim is definitely FALSE
(C) 75% Accuracy
(D) Yields unique answer

Correct Answer: (D) | **Explanation:** For **Either Alone Sufficient** (Sufficiency Outcome), the verified Condition on Statement I Alone is **Yields unique answer**. Furthermore, Yields unique answer. (Source: UPSC Official Portal & IUC Academy).

Practice Question #68 High-Yield Comparative MCQ

Q68. With reference to Sufficiency Outcome and Condition on Statement I Alone, which of the following is accurately matched with "Both Together Required"?

(A) Yields multiple values
(B) Proves claim is definitely FALSE
(C) 75% Accuracy
(D) 80% Accuracy

Correct Answer: (A) | **Explanation:** For **Both Together Required** (Sufficiency Outcome), the verified Condition on Statement I Alone is **Yields multiple values**. Furthermore, Yields multiple values. (Source: UPSC Official Portal & IUC Academy).

Practice Question #69 High-Yield Comparative MCQ

Q69. With reference to Sufficiency Outcome and Condition on Statement I Alone, which of the following is accurately matched with "Neither / Insufficient"?

(A) Proves claim is definitely FALSE
(B) Yields multiple values
(C) 75% Accuracy
(D) 80% Accuracy

Correct Answer: (B) | **Explanation:** For **Neither / Insufficient** (Sufficiency Outcome), the verified Condition on Statement I Alone is **Yields multiple values**. Furthermore, Yields multiple values. (Source: UPSC Official Portal & IUC Academy).

Practice Question #70 High-Yield Comparative MCQ

Q70. With reference to Sufficiency Outcome and Condition on Statement I Alone, which of the following is accurately matched with “Definite "No" on Yes/No Stem”?

(A) 75% Accuracy
(B) 80% Accuracy
(C) Proves claim is definitely FALSE
(D) None of the above parameters for Definite "No" on Yes/No Stem

Correct Answer: (C) | **Explanation:** For **Definite "No" on Yes/No Stem** (Sufficiency Outcome), the verified Condition on Statement I Alone is **Proves claim is definitely FALSE**. Furthermore, Fails to prove True or False. (Source: UPSC Official Portal & IUC Academy).

Practice Question #71 High-Yield Comparative MCQ

Q71. With reference to Attempt Volume (N Qs) and Assumed Accuracy Rate, which of the following is accurately matched with “40 Questions”?

(A) 80% Accuracy
(B) Sum of all digits must be divisible by 3 or 9 respectively
(C) None of the above parameters for 40 Questions
(D) 75% Accuracy

Correct Answer: (D) | **Explanation:** For **40 Questions** (Attempt Volume (N Qs)), the verified Assumed Accuracy Rate is 75% **Accuracy**. Furthermore, **30 Correct / 10 Wrong**. (Source: UPSC Official Portal & IUC Academy).

Practice Question #72 High-Yield Comparative MCQ

Q72. With reference to Attempt Volume (N Qs) and Assumed Accuracy Rate, which of the following is accurately matched with “48 Questions”?

(A) 75% Accuracy
(B) 80% Accuracy
(C) Sum of all digits must be divisible by 3 or 9 respectively
(D) Last 2 digits divisible by 4; last 3 digits divisible by 8

Correct Answer: (A) | **Explanation:** For **48 Questions** (Attempt Volume (N Qs)), the verified Assumed Accuracy Rate is 75% **Accuracy**. Furthermore, **36 Correct / 12 Wrong**. (Source: UPSC Official Portal & IUC Academy).

Practice Question #73 High-Yield Comparative MCQ

Q73. With reference to Attempt Volume (N Qs) and Assumed Accuracy Rate, which of the following is accurately matched with “52 Questions”?

(A) 75% Accuracy
(B) 80% Accuracy
(C) Sum of all digits must be divisible by 3 or 9 respectively
(D) Last 2 digits divisible by 4; last 3 digits divisible by 8

Correct Answer: (B) | **Explanation:** For **52 Questions** (Attempt Volume (N Qs)), the verified Assumed Accuracy Rate is 80% **Accuracy**. Furthermore, **42 Correct / 10 Wrong**. (Source: UPSC Official Portal & IUC Academy).

Practice Question #74 High-Yield Comparative MCQ

Q74. With reference to Attempt Volume (N Qs) and Assumed Accuracy Rate, which of the following is accurately matched with "56 Questions"?

(A) Sum of all digits must be divisible by 3 or 9 respectively

(B) Last 2 digits divisible by 4; last 3 digits divisible by 8

(C) 75% Accuracy

(D) Difference between 3-digit triplets from right to left divisible by 7, 11, or 13

Correct Answer: (C) | **Explanation:** For **56 Questions** (Attempt Volume (N Qs)), the verified Assumed Accuracy Rate is **75% Accuracy**. Furthermore, **42 Correct / 14 Wrong**. (Source: UPSC Official Portal & IUC Academy).

Practice Question #75 High-Yield Comparative MCQ

Q75. With reference to Attempt Volume (N Qs) and Assumed Accuracy Rate, which of the following is accurately matched with "64 Questions"?

(A) Sum of all digits must be divisible by 3 or 9 respectively

(B) Last 2 digits divisible by 4; last 3 digits divisible by 8

(C) Difference between 3-digit triplets from right to left divisible by 7, 11, or 13

(D) 75% Accuracy

Correct Answer: (D) | **Explanation:** For **64 Questions** (Attempt Volume (N Qs)), the verified Assumed Accuracy Rate is **75% Accuracy**. Furthermore, **48 Correct / 16 Wrong**. (Source: UPSC Official Portal & IUC Academy).

Rapid-Fire Last-Minute One-Liner Revision Capsule

1. **Zero Parity:** 0 is an even integer (0 = 2 * 0) and is neither positive nor negative (NCERT Portal).
2. **Smallest Prime:** 2 is the smallest and only even prime number; 1 is neither prime nor composite.
3. **Twin Primes:** Prime pairs differing by 2 (such as (3,5), (5,7), (11,13), (17,19)); there are 8 twin prime pairs between 1 and 100.
4. **Prime Count 1–100:** Exactly 15 primes exist from 1 to 50, and 10 primes exist from 51 to 100 (total 25).
5. **Perfect Squares:** A perfect square can never end with digits 2, 3, 7, or 8 and always has an odd number of total factors.
6. **Digital Root:** The digital root (repeated sum of digits until a single digit) of a perfect square is always 1, 4, 7, or 9.
7. **Divisibility by 7, 11, 13:** Since 7 11 13 = 1001, any number of the form abcabc is divisible by 7, 11, 13, and 1001.
8. **Two-Digit Repeat (ababab):** Any 6-digit number of the form ababab (ab * 10101) is always divisible by 3, 7, 13, 37, and 10101.
9. **HCF-LCM Product:** For any two positive integers a and b, HCF(a, b) $LCM(a, b) = a\,b$.
10. **Fractional HCF & LCM:** HCF of Fractions = HCF(Numerators) / LCM(Denominators) and LCM of Fractions = LCM(Numerators) / HCF(Denominators).
11. **Remainder with Same Difference:** Greatest number dividing a, b, c leaving the same remainder is HCF(|a - b|, |b - c|, |c - a|).

12. **LCM with Constant Difference `k`:** Smallest number divided by `a, b, c` leaving remainders `r1, r2, r3` where `(a-r1) = (b-r2) = (c-r3) = k` is `LCM(a, b, c) - k`.

13. **Fermat Little Theorem:** If `p` is prime and `HCF(a, p) = 1`, then `a^(p - 1)` divided by `p` leaves remainder `1`.

14. **Wilson Theorem:** If `p` is a prime number, `(p - 1)!` divided by `p` always leaves remainder `(p - 1)`.

15. **Trailing Zeros in `100!`:** Number of trailing zeros in `100!` is `floor(100/5) + floor(100/25) = 20 + 4 = 24`.

16. **Sum of First `n` Naturals:** `1 + 2 + ... + n = n * (n + 1) / 2`.

17. **Sum of First `n` Squares:** `1^2 + 2^2 + ... + n^2 = n (n + 1) (2n + 1) / 6`.

18. **Sum of First `n` Cubes:** `1^3 + 2^3 + ... + n^3 = (n * (n + 1) / 2)^2`.

19. **Sum of First `n` Odd Numbers:** `1 + 3 + 5 + ... + (2n - 1) = n^2` (hence average of first `n` odd numbers is `n`).

20. **Sum of First `n` Even Numbers:** `2 + 4 + 6 + ... + 2n = n * (n + 1)` (hence average of first `n` even numbers is `n + 1`).

21. **Arithmetic Progression (AP):** `n`-th term `T_n = a + (n - 1)d`; *sum of* `n` *terms* `S_n = (n/2)` (2a + (n - 1)*d).

22. **Geometric Progression (GP):** `n`-th term `T_n = a * r^(n - 1)`; infinite sum for `|r| < 1` is `S_inf = a / (1 - r)`.

23. **AM-GM Inequality:** For any positive real numbers, `Arithmetic Mean (AM) >= Geometric Mean (GM) >= Harmonic Mean (HM)`.

24. **Equivalent Single Discount:** Two successive discounts of `a%` and `b%` equal a single discount of `(a + b - (a * b) / 100)%`.

25. **False Weight Gain:** Selling at cost price using `800 g` instead of `1000 g` yields `((1000 - 800) / 800) * 100 = 25%` profit.

26. **Rule of 72:** Under compound interest at `R%` per annum, money doubles in approximately `72 / R` years.

27. **SI Doubling vs. Tripling:** If a sum doubles in `T` years at Simple Interest (`100%` interest), it triples (`200%` interest) in `2T` years.

28. **CI Doubling vs. 8-Fold:** If a sum doubles in `T` years at Compound Interest, it becomes `8 times` (`2^3`) in `3T` years.

29. **Harmonic Mean Speed:** Going from A to B at `x km/hr` and returning at `y km/hr` gives `Average Speed = (2 x y) / (x + y)`.

30. **Early-Late Distance Formula:** If speeds `S1` and `S2` differ in arrival time by `Delta_T` hours, `Distance = (S1 S2 Delta_T) / |S1 - S2|`.

31. **After-Meeting Time (`Sqrt` Rule):** If A and B start towards each other and reach destinations in `t1` and `t2` hours after meeting, `Speed_A / Speed_B = sqrt(t2 / t1)`.

32. **Circular Track First Meeting:** Two runners with speeds `u` and `v` on track length `L` meet first in `L / |u - v|` (same direction) or `L / (u + v)` (opposite).

33. **Circular Permutations:** `n` distinct people sit at a circular table in `(n - 1)!` ways; `n` beads form a necklace in `(n - 1)! / 2` ways.

34. **Chessboard Squares & Rectangles:** A standard `8 * 8` chessboard has `204 squares` (`1^2 + ... + 8^2`) and `1,296 rectangles` (`36^2`).

35. **Coin Toss Sample Space:** Tossing `n` coins gives `2^n` total outcomes; probability of getting exactly `r` heads is `nCr / 2^n`.

36. **Dice Roll Sample Space:** Rolling `n` six-sided dice gives `6^n` outcomes; when `2` dice are rolled, the most probable sum is `7` (`P(7) = 6/36 = 1/6`).

37. **Standard Deck of 52 Cards:** Contains `4 suits` (26 Red: Hearts/Diamonds; 26 Black: Spades/Clubs), `12 face cards` (`J, Q, K`), and `4 Aces`.

38. **Leap Year 53 Sundays:** An ordinary year has `1/7` probability of 53 Sundays; a leap year has `2/7` probability of 53 Sundays.

39. **Clock Hands Coincidence:** Hands of a clock coincide every `65 5/11 minutes` (`720 / 11 minutes`), totaling `22 times` in 24 hours.

40. **Clock Hands Right Angles:** Hands of a clock are perpendicular (`90 degrees`) `22 times` in 12 hours and `44 times` in 24 hours.

41. **Clock Mirror Time:** Subtract given clock time from `11:60` (or `23:60`) to obtain its exact vertical mirror reflection.

42. **Syllogism Universal Rule:** Two negative statements (`No A is B` + `No B is C`) or two particular statements (`Some A are B` + `Some B are C`) yield **no definite conclusion** between `A` and `C`.

43. **Negation Test for Assumptions:** Negating a valid assumption must logically invalidate the author's main conclusion in Reading Comprehension (IUC Academy).

44. **Extreme Word Filter:** RC options containing `"only"`, `"always"`, `"never"`, or `"completely"` are incorrect in >95% of UPSC CSAT passages.

45. **Pie Chart Degree Conversion:** `1%` of a pie chart equals `3.6 degrees`, and `90 degrees` equals `25%` (`1/4th`).

46. **Data Sufficiency "No" Rule:** A statement that proves the answer to a Yes/No question is definitely **"No"** is `100% Sufficient`.

47. **Prime Squares (`p^2 - 1`):** For any prime number `p > 3`, `p^2 - 1` is always divisible by `24` (`p^2 = 24k + 1`).

48. **Sum of Factors of `2^n`:** The sum of all positive factors of `2^n` is `(2^(n+1)) - 1`.

49. **Euler Totient of `100`:** `phi(100) = 100 (1 - 1/2) (1 - 1/5) = 40` numbers less than 100 are coprime to 100.

50. **Triangle Inequality:** Three lengths `a, b, c` form a non-degenerate triangle if and only if `a + b > c`, `b + c > a`, and `c + a > b`.

51. **Pythagorean Triplets:** Memorize `(3,4,5), (5,12,13), (7,24,25), (8,15,17), (9,40,41), (11,60,61), (20,21,29)` for Direction Sense.

52. **Interior Angles of Polygon:** Sum of interior angles of an `n`-sided convex polygon is `(n - 2) * 180 degrees`; sum of exterior angles is always `360 degrees`.

53. **Handshake Formula:** If `n` people shake hands with one another once, total handshakes = `n * (n - 1) / 2`.

54. **Exchange of Gifts:** If `n` people each give a gift to every other person, total gifts exchanged = `n * (n - 1)`.

55. **Derangement of 4 Items:** Number of ways 4 letters can be placed into 4 envelopes such that none is correct is `D(4) = 9`.

56. **Cube Cutting Formula:** Maximum pieces obtained by making `K` planar cuts on a cube (`K = x + y + z`) is `(x + 1) (y + 1) (z + 1)`.

57. **Painted Cube Unpainted Core:** For a cube cut into `n^3` smaller cubes, unpainted inner cubes = `(n - 2)^3`.

58. **Alphabet Rank Anchors:** `E=5, J=10, O=15, T=20, Y=25` (`EJOTY`); opposite letter ranks always add up to `27`.

59. **CSAT Qualifying Benchmark:** UPSC CSAT Paper-II requires `33%` (`66.67 out of 200 marks`), equivalent to `27 net correct questions` (UPSC Portal).

60. **Negative Penalty Ratio:** In UPSC CSAT (`+2.5` for right, `-0.833` for wrong), `3 wrong answers` cancel out `1 right answer`.

IUC Academy *1-3-7-21* Day Spaced-Revision & Self-Assessment Tracker (www.iucacademy.com)

Chapter / Study Section	Day 1 (First Read)	Day 3 (Active Recall)	Day 7 (MCQ Drill)	Day 21 (Exam Ready)
1. Chapter 1: Number System, Divisibility, Remainder Theorems & Base System Arithmetic	☐ Completed (100% Concept Clarity)	☐ Flowchart & Tables Revised	☐ 75+ MCQs Solved (>85% Accuracy)	☐ **Final Rapid Recall Ready**
2. Chapter 2: Percentages, Profit-Loss, Interest, Ratios, Mixtures & Time-Work-Distance	☐ Completed (100% Concept Clarity)	☐ Flowchart & Tables Revised	☐ 75+ MCQs Solved (>85% Accuracy)	☐ **Final Rapid Recall Ready**
3. Chapter 3: Permutations, Combinations, Probability & Modern Set Theory	☐ Completed (100% Concept Clarity)	☐ Flowchart & Tables Revised	☐ 75+ MCQs Solved (>85% Accuracy)	☐ **Final Rapid Recall Ready**
4. Chapter 4: Logical Deductive Reasoning: Syllogisms, Blood Relations, Direction Sense & Coding	☐ Completed (100% Concept Clarity)	☐ Flowchart & Tables Revised	☐ 75+ MCQs Solved (>85% Accuracy)	☐ **Final Rapid Recall Ready**
5. Chapter 5: Analytical Reasoning: Seating Arrangements, Complex Puzzles, Clocks & Calendars	☐ Completed (100% Concept Clarity)	☐ Flowchart & Tables Revised	☐ 75+ MCQs Solved (>85% Accuracy)	☐ **Final Rapid Recall Ready**
6. Chapter 6: Critical Reasoning & Reading Comprehension (Assumptions, Inferences, Corollaries & Crux)	☐ Completed (100% Concept Clarity)	☐ Flowchart & Tables Revised	☐ 75+ MCQs Solved (>85% Accuracy)	☐ **Final Rapid Recall Ready**
7. Chapter 7: Data Interpretation, Quantitative Charts & Data Sufficiency (2-Statement & 3-Statement)	☐ Completed (100% Concept Clarity)	☐ Flowchart & Tables Revised	☐ 75+ MCQs Solved (>85% Accuracy)	☐ **Final Rapid Recall Ready**
8. Chapter 8: Decision Making, Interpersonal Skills, Visual Reasoning & CSAT Exam Strategy	☐ Completed (100% Concept Clarity)	☐ Flowchart & Tables Revised	☐ 75+ MCQs Solved (>85% Accuracy)	☐ **Final Rapid Recall Ready**
9. Solved Exam Practice Questions (MCQs)	☐ Completed (100% Concept Clarity)	☐ Flowchart & Tables Revised	☐ 75+ MCQs Solved (>85% Accuracy)	☐ **Final Rapid Recall Ready**
10. Extended Comparative & Analytical Practice Set (Questions 36–75)	☐ Completed (100% Concept Clarity)	☐ Flowchart & Tables Revised	☐ 75+ MCQs Solved (>85% Accuracy)	☐ **Final Rapid Recall Ready**
11. Rapid-Fire Last-Minute One-Liner Revision Capsule	☐ Completed (100% Concept Clarity)	☐ Flowchart & Tables Revised	☐ 75+ MCQs Solved (>85% Accuracy)	☐ **Final Rapid Recall Ready**