VPM CLASSES

CSIR - GENERAL APTITUDE (PART A)

SAMPLE THEORY

CSIR UGC NET

- Alligation or Mixture
- Probability
- Simple and Compound Interest
- Permutation and combination

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- *Alligation or Mixture*
- *Simple and Compound Interest*
- *Probability*
- *Permutation and combination*

VPM CLASSES

For IIT-JAM, JNU, GATE, NET, NIMCET and Other Entrance Exams

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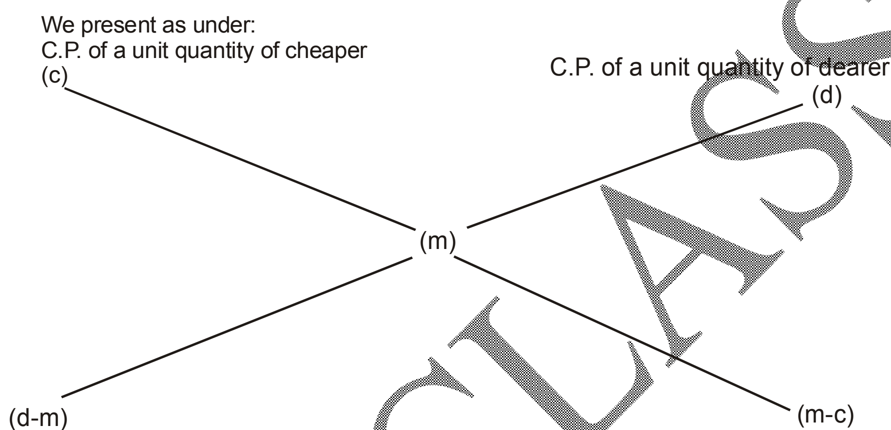
ALLIGATION OR MIXTURE

I. **Alligation:** It is the rule that enables us to find the ratio in which two or more ingredients at the given price must be mixed to produce a mixture of a desired price.

II. **Mean Price:** The cost price of a unit quantity of the mixture is called the mean price.

III. **Rule of Alligation:** If two ingredients are mixed, then

$$\frac{\text{(Quantity of cheaper)}}{\text{(Quantity of dearer)}} = \frac{\text{(C.P. of dearer) - (Mean price)}}{\text{(Mean price) - (C.P. of cheaper)}}$$



IV. Suppose a container contains x units of liquid from which y units are taken out and replaced by water. After n operations the quantity of pure liquid=[$x(1-y/x)^n$]units.

Alligation Rule.

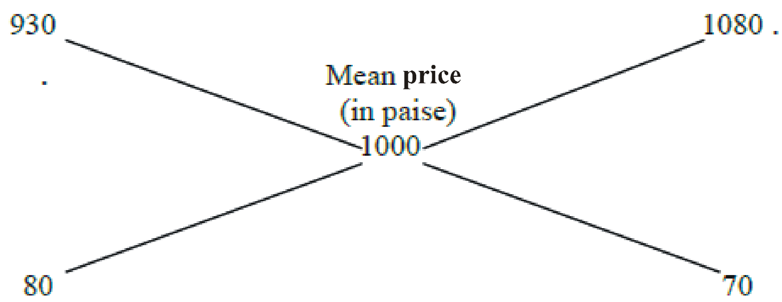
The alligation rule states that "when different quantities of the same or different ingredients, of different costs (one cheap and the other dear) are mixed together to produce a mixture of a mean cost, the ratio of their quantities are inversely proportional to the difference in their cost from the mean cost".

$$\frac{\text{Quantity of Cheap}}{\text{Quantity of Dear}} = \frac{\text{Price of Dear} - \text{Mean Price}}{\text{Mean PrIce} - \text{Price of Cheap}}$$

Ex. In what ratio must rice at Rs. 9.30 per kg be mixed with rice at Rs. 10.80 per kg so that the mixture be worth Rs. 10 per kg ?

Sol. By the rule of alligation, we have:

C.P. of 1 kg rice of 1st kind (in paise) C.P. of 1 kg rice of 2nd kind (in paise)



$$\frac{1080-1000}{1000-930}=\frac{80}{70}=\frac{8}{7}$$

SIMPLE INTEREST

I. **Principal:** The money borrowed or lent out for a certain period is called the principal or the sum.

II. **Interest:** Extra money paid for using other's money is called interest.

III. **Simple Interest (S.I.) :** If the interest on a sum borrowed for a certain period is reckoned uniformly, then it is called simple interest.

Let Principal = P, Rate = R% per annum (p.a.) and Time = T years. Then,

(i) S.I. = (P x R x T) / 100

(ii) P = (100 x S.I) / (R x T) ; R = (100 x S.I) / (P x T) and T = (100 x S.I) / (P x R)

COMPOUND INTEREST

Compound Interest: Sometimes it so happens that the borrower and the lender agree to fix up a certain unit of time, say yearly or half-yearly or quarterly to settle the previous account.

In such cases, the amount after first unit of time becomes the principal for the second unit,the amount after second unit becomes the principal for the third unit and so on.

After a specified period, the difference between the amount and the money borrowed is called the Compound Interest (abbreviated as C.I.) for that period.

Important facts & formulae

Let Principal = P, Rate = R% per annum, Time = n years.

I. When interest is compounded Annually:

Amount = $P(1 + R/100)^n$

II. When interest is compounded Half-yearly:

Amount = $P[1 + (R/2)/100]^{2n}$

III. When interest is compounded Quarterly:

Amount = $P[1 + (R/4)/100]^{4n}$

IV. When interest is compounded Annually but time is in fraction, say 3(2/5) years.

Amount = $P(1 + R/100)^3 \times (1 + (2R/5)/100)$

V. When Rates are different for different years, say R1%, R2%, R3% for 1st, 2nd and 3rd year respectively.

Then, Amount = $P(1 + R_1/100)(1 + R_2/100)(1 + R_3/100)$

VI. Present worth of Rs.x due n years hence is given by :

Present Worth = $x/(1+(R/100))^n$

Ex. Find compound interest on Rs. 7500 at 4% per annum for 2 years, compounded annually.

Sol. Amount = Rs $[7500 \times (1 + (4/100)^2]$ = Rs $(7500 \times (26/25) \times (26/25))$ = Rs. 8112.

therefore, C.I. = Rs. (8112 - 7500) = Rs. 612.

PROBABILITY

Important facts & formulae

I. **Experiment** :An operation which can produce some well-defined outcome is called an experiment

II. **Random experiment:** An experiment in which all possible outcomes are known and the exact output cannot be predicted in advance is called an random experiment

Eg of performing random experiment:

(i) rolling an unbiased dice

(ii) tossing a fair coin

(iii) drawing a card from a pack of well shuffled card

(iv) picking up a ball of certain color from a bag containing ball of different colors

Details:

(i)when we throw a coin. Then either a head (h) or a tail (t) appears.

(ii)a dice is a solid cube, having 6 faces, marked 1, 2, 3, 4, 5, 6 respectively. When we throw a die, the outcome is the number that appears on its top face .

(iii)a pack of cards has 52 cards; it has 13 cards of each suit ,namely spades, clubs ,hearts and diamonds

– Cards of spades and clubs are black cards

– Cards of hearts and diamonds are red cards

There are 4 honors of each suit

These are aces , king , queen and jack

These are called face cards

III. **Sample space :** When we perform an experiment ,then the set S of all possible outcomes is called the sample space

e.g. of sample space:

(i) in tossing a coin ,s={h,t}

(ii) if two coins are tossed ,then s={hh,tt,ht,th}.

(iii) in rolling a die we have,s={1,2,3,4,5,6}.

IV. **event :** Any subset of a sample space.

V. **Probability of occurrence of an event.**

let S be the sample space and E be the event .

then, $E \subseteq S$.

$P(E)=n(E)/n(S)$.

VI. Results on Probability:

(i) $P(S) = 1$

(ii) $0 \leq P(E) \leq 1$

(iii) $P(\phi) = 0$

(iv) For any event a and b, we have:

$P(a \cup b)=P(a)+P(b)-P(a \cup b)$

(v) If $\bar{A}$ denotes (not-a), then $P(A)=1-P(A)$.

PERMUTATIONS AND COMBINATIONS

Factorial Notation: Let n be a positive integer. Then, factorial n, denoted by n! is defined as:

$$n! = n\,(n-1)\,(n-2)........3.2.1.$$

Examples: (i) 5! = (5x 4 x 3 x 2 x 1) = 120; (ii) 4! = (4 x 3 x 2 x 1) = 24 etc.

We define, 0! = 1.

Permutations: The different arrangements of a given number of things by taking some or all at a time, are called permutations.

Ex. All permutations (or arrangements) made with the letters a, b, c by taking two at a time are: (ab, ba, ac, bc, cb).

Ex. All permutations made with the letters a,b,c, taking all the letters at a time are: (abc, acb, bca, cab, cba).

Number of Permutations: Number of all permutations of n things, taken r at a time, given by:

$$^{n}P_{r} = n(n-1)(n-2).....(n-r+1) = \frac{n!}{(n-r)!}$$

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Combinations: Each of the different groups or selections which can be formed by taking some or all of a number of objects, is called a combination.

Ex. Suppose we want to select two out of three boys A, B, C. Then, possible selections are AB, BC and CA.
Note that AB and BA represent the same selection.

Ex. All the combinations formed by a, b, c, taking two at a time are ab, bc, ca.

Ex. The only combination that can be formed of three letters a, b, c taken all at a time is abc.

Ex. Various groups of 2 out of four persons A, B, C, D are:
AB, AC, AD, BC, BD, CD.

Ex. Note that ab and ba are two different permutations but they represent the same combination.

Number of Combinations: The number of all combination of n things, taken r at a time is:

$$^{n}C_{r} = \frac{n!}{(r!)(n-r)!} = n(n-1)(n-2).....\text{to r factors} / r!$$

Note that: $^{n}c_{r} = 1$ and $^{n}c_{0} = 1$.

An Important result: $^{n}c_{r} = {}^{n}c_{(n-r)}$.

Ex. (i) $^{11}c_{4} = \frac{(11\times 10\times 9\times 8)}{(4\times 3\times 2\times 1)} = 330$

(ii) $^{16}c_{13} = {}^{16}c_{(16-13)} = \frac{16\times 15\times 14}{3!} = \frac{16\times 15\times 14}{3\times 2\times 1} = 560$