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Q1 If a task can be done in n_1 ways and a second task can be done in n_2 ways if these two task cannot be do at a same time then there are $n_1 + n_2$ ways to do the task

Ex:- Suppose a committe award computer either of the professor or students how many different choices are there if there are 10 professors or 8 students

$\Rightarrow 10 + 8 = 18$ ways

Q2 If a task can be done in n_1 ways for each of these ways to do the second task in n_2 ways then total no. of ways to do the task are $n_1 \times n_2$ ways.

Ex:- How many different bits string of length 7 are there

$\Rightarrow 2^7 = 120$ ways

Q3 $P(n,r) = \frac{n!}{(n-r)!}$

Q4 $C(n,r) = \frac{n!}{(n-r)!\, r!}$

Q5 for permutation

- ${}^nP_r = \frac{n!}{(n-r)!}$
- order matter

for combination

- ${}^nC_r = \frac{n!}{r!\,(n-r)!}$
- order doesnot matter

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Q6 Given : BANANA
$n : 6$
no. of $A = 3$
no. of $N = 2$

$$^nP_r = \frac{n!}{3!\,2!} = \frac{6!}{3!.2!} = \frac{6\times5\times4\times\cancel{3!}}{\cancel{3!}\cdot2!} = \frac{6\times5\times4^2}{2} = 60$$

Q7 • formula for circular permutation $= (n-1)!$ if clockwise and anticlockwise order are different.
• $(n-1)!/2!$ if order are not different

Q9 Pigeon hole principle: if items are put into container with atleast one container must contain one or more then one item

Q10 It state that if n objects (pigeons) are distributed into k boxes (pigeon hole) then there is atleast one box containing $[N/K]$ or mor object.

Q11 $n = 6$
$r = 3$
$$^nP_r = {}^6P_3 = \frac{6!}{(6-3)!} = \frac{6\times5\times4\times\cancel{3!}}{\cancel{3!}} = 120 \text{ Ans}$$

Q12 The word Benzene contain 7 letters
E contain 3 letters
n contain 2 letter
no. permutation $= \frac{7!}{3!.2!} = \frac{7\times6\times5\times4^2\times\cancel{3!}}{\cancel{3!}\cdot\cancel{2!}} = 7\times6\times5\times2$
$= 420$ Ans

Q13 with Replacement

1 Card can be Choosen in 52 ways
2 Card could be choose in 52 ways
3 also choose in 52 ways
So total no. of ways = $52 \times 52 \times 52 = 1,40,608$

without Replacement $52C_3 = \frac{52!}{3!(52-3)!} = \frac{52!}{3! \times 49!}$

$= \frac{52 \times 51 \times 50 \times \cancel{49!}}{3 \times 2 \times 1 \times \cancel{49!}} = 22,100$

Q14 total no. of Element = 4
$r = 3$

$4C_3 = \frac{4!}{3!(4-3)!} = \frac{4!}{3!} = 4$ Ans

Q15 Choice of 3 of 6 cows
$6C_3 = \frac{6!}{3!(6-3)!} = \frac{6!}{3! \cdot 3!} = 20$

Choice of 2 of 5 pigs $5C_2 = \frac{5!}{2!(5-2)!} = \frac{5!}{2! \cdot 3!} = 10$

Choice of 4 of 8 hens $8C_4 = \frac{8!}{4!(8-4)!} = \frac{8!}{4! \cdot 4!} = 70$

total choices $= 20 \times 10 \times 17 = 14,000$

Q.16 is in Page-13

Q17 $K+1=3$

$K=2$

$n=12$

so, $K(n)+1$

$2(12)+1 \Rightarrow 25$

Q18 (i) No. of ways that 7 person arrange themselves in a row

$$^7P_7 = \frac{7!}{(7-7)!} = \frac{7!}{0} = 5040$$

(ii) No. of ways that 7 person arrange themselves in circular table.

$$(n-1)!$$
$$(7-1)! = 720$$

Q19 (a) The no. of ways that two balls is drawn from the box in any colour $C(14,2)$

$$^{14}C_2 = \frac{14!}{2!(14-2)!} = \frac{14!}{2! \cdot 12!}$$

(b) If they must be same colour then $C(8,2)$ and $C(6,2)$

$$^8C_2 \times {}^6C_2$$

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Q20 Total no. of person = 12

no. of person to be selected = 5

out of 5 there is 1 Chairman

$\therefore$ for selecting Chairman $^{12}C_1 = 12$

no. of ways selecting other 4 out of remaining 11 Persons = $^{11}C_4$

$\therefore$ total no. of ways = $^{12}C_1 \times {}^{11}C_4$

$= 12 \times \frac{11!}{4!(11-4)!} = \frac{12 \times 11 \cdot 10 \cdot 9 \cdot 8}{4 \cdot 3 \cdot 2 \cdot 1} = 3960$

Q21 History class contains 8 males and 6 females Students

so total student in the class 14 Students

a) 1 CR $= {}^{14}C_1 = \frac{14!}{1! \cdot (14-1)!} = \frac{14 \times \cancel{13!}}{\cancel{13!}} = 14$

b) 2 CR $= {}^8C_1 \times {}^6C_1 = 48$

Q22 no. of student female = 22 ← Q22

no. of male students = 18

total no. of students = 22+18 = 40

Q24 $\frac{12!}{4! \cdot 4! \cdot 4!} = 34650$ Ans ← Q24

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Q28 (a): Here the sum rules applies ; hence $n = 5+3+6+4 = 18$
(b) Here the product rules applies ; hence $n = 5*3*6*4 = 360$

Q25

12 takes A	5 takes A and B	3 takes ABC	2 take All for
20 takes B	7 takes A and C	2 takes ABD	71 take none
20 takes C	4 takes A and D	2 takes BCD	
8 takes D	16 takes B and C	3 takes ACD	
	4 takes B and D		
	3 takes C and D		

$T = S_1 - S_2 + S_3 - S_4$ thus $T = 29$
$= 60 - 39 + 10 - 2$ and $N = 71 + T$
$= 29$ $= 71 + 29 = 100$ Ans

$S_1 = 12+20+20+8 = 60$
$S_2 = 5+7+4+16+4+3 = 39$
$S_3 = 3+2+2+3 = 10$
$S_4 = 2$

26 Let french be F
Germany be G
and Russian with R
then
no. of student study french $n(F) = 65$
no. of student study german $n(G) = 45$
no. of student study russian $n(R) = 42$
no. of student study french and german $n(F \cap G) = 20$
no. of student study french and russian $n(F \cap R) = 25$
no. of student study german and russian $n(G \cap R) = 15$
no. of student study all three course $n(F \cap G \cap R) = 8$

we use the formula $n(A\cup B\cup C) = n(A)+n(B)+n(C)-n(A\cap B)-n(A\cap C)-n(B\cap C) + n(A\cap B\cap C)$

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$n(F\cup G\cup R) = n(F)+n(G)+n(R)-n(F\cap G)-n(F\cap R)-n(G\cap R) + n(F\cap G\cap R)$

$n(F\cup G\cup R) = 65+45+42-20-15-25+8$
$= 100$

Q27 in Page - 8 | Q29, 30 in Page 13

28 (a) $N(P\cup B) = N(P)+N(B)-N(P\cap B)$
$N(P\cap B) = 30+14-32 = 12$

(b) $N(P\,only) = N(P) - N(P\cap B) = 30-12 = 18$
(c) $N(B\,only) = N(B) - N(P\cap B) = 14-12 = 2$

Q31 PROPOSITION

11 letter
2 P's
3 O's
2 I's there are $\frac{11!}{2!\,3!\,2!} =$

BASEBALL

8 letter
2 B's
2 A's
2 L'S
1 S
1 E'

$\frac{8!}{2!\,2!\,2!\,1!\,1!} =$

Committee

9 letter
m → 2's
t → 2's
e → 2's there are $\frac{9!}{2!\cdot 2!\cdot 2!} =$

QUEUE

5 letter
U → 2's
E → 2's
There are $\frac{5!}{2!\cdot 2!} =$

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Q32 The number of red flags = 4
The number of white flags = 2
The number of green flags = 3
∴ there are total 9 flags

On using the formula, $\frac{n!}{(p! \times q! \times r!)} = \frac{9!}{4! \cdot 2! \cdot 3!} = 1260$

Q27 (a) Here $k+1 = 4$
$k = 3$
the five letter partition into $n = 6$ subsets (Pigeonhole)
$kn+1$
$6(3)+1 = 19 < 21$ that some subset has atleast four constants

(b) $k+1 = 5$
$k = 4$

$kn+1$
$4(5)+1 = 21$ thus some sublist has at least five constar

Q34 (a) Each student in the ordered sample can be choose in 10 ways
$n = 10 \cdot 10 \cdot 10 \cdot 10 = 10^4 = 10000$. sample size 4 with replaceme

(b) $n = 10 \times 9 \times 8 \times 7 = 5040$. size 4 without replacment

Q33 (a) box contain 12 lightbulbs
So $n = 12 \times 12 \times 12$ sample size 3 with replecement

(b) $n = 12 \times 11 \times 10 = 1320$ sample size 3 without replecement

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40 (a) $^{10}C_2 = \frac{10!}{2!(10-2)!} = \frac{10!}{2! \cdot 8!} = \frac{10 \times 9 \times \cancel{8!}}{2! \times \cancel{8!}} = 45$ ways

(b) $6 \times 4 = 24$ ways

(c) $6C_2 + {}^4C_2$

$\frac{6!}{2!(6-2)!} + \frac{4!}{2!(4-2)!}$

$= \frac{6!}{2! \times 4!} + \frac{4!}{2! \cdot 2!}$

$= \frac{3.6 \times 5 \times \cancel{4!}}{2! \times \cancel{4!}} + \frac{4 \times 3 \times \cancel{2!}}{2! \cdot \cancel{2!}}$

$= 15 + 6 = 21$ ways

35 A Restaurant has 6 different dessert

(a) 1 desert : $6C_1 = \frac{6!}{1!(6-1)!} = \frac{6 \times \cancel{5!}}{\cancel{5!}} = 6$

(b) 2 desert : $6C_2$ $\frac{6!}{2!(6-2)!} = \frac{3.6 \times 5 \times \cancel{4!}}{2! \times \cancel{4!}} = 15$

(c) 3 desert : $6C_3$ $\frac{6!}{3!(6-3)!} = \frac{\cancel{6} \times 5 \times 4 \times \cancel{3!}}{\cancel{3 \times 2 \times 1} \; \cancel{3!}} = 2 \times 5 \times 2 = 20$

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(36) Class contain 9 mens and 3 womens
total no. of students $(9+3) = 12$

(a) ${}^{12}C_4 = \frac{12!}{4!(12-4)!} = \frac{12\times11\times10\times9\times\cancel{8!}}{4!\times\cancel{8!}} = \frac{12\times11\times10\times9}{4\times3\times2\times1} = 495$

(b) ${}^{9}C_2 \cdot {}^{3}C_2 = \frac{9!}{2!(9-2)!} = \frac{9\times8\times\cancel{7!}}{2\times1\cdot\cancel{7!}} = 36$

$\frac{3!}{2!(3-2)!} = \frac{3\times2\times1}{2\times1\times1} = 3$

$\Rightarrow 36\times3 = 108$

(c) ${}^{9}C_3 \cdot 3$

$\frac{9!}{3!(9-3)!}\cdot 3 = \frac{9\times8\times7\times\cancel{6!}}{3\times2\times1\times\cancel{6!}}\cdot 3 = 252$

(d) ${}^{12}C_4 - {}^{9}C_4$

$\frac{12!}{4!(12-4)!} - \frac{9!}{4!(9-4)!}$

$\frac{12!}{4!\cdot8!} - \frac{9!}{4!\cdot5!} = 369$

Q37 in Page-14

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38 A class contain 8 men and 6 womens
total no. of students $8+6 = 14$ students

no. ways to a techer can select husband or wife but not both
$^{12}C_4 + 2 \cdot {^{12}C_3} = 935$

Q89 in page-15
Q90 in page-9

42 24 own a foreign made car $n(A) = 24$
60 own a domestic made car $n(B) = 60$
survey having 80 car $\Rightarrow n(A \cup B) = 80$

(a) $n(A \cup B) = n(A) + n(B) - n(A \cap B)$
$80 = 24 + 60 - n(A \cap B)$
$n(A \cap B) = 84 - 80$
$n(A \cap B) = 4$

(b) $n(A \text{ only}) = n(A) - n(A \cap B)$
$= 24 - 4 = 20$

(c) $n(B \text{ only}) = n(B) - n(A \cap B)$
$= 60 - 4$
$= 56$

Q43 Let A_1 and A_2 the event of getting A in first and second test respectively
then it is given
$n(A_1) = 10$, $n(A_2) = 9$, $n(A_1 \cup A_2)' = 15$

$n(A_1 \cup A_2) = n - n(A \cup B)'$
$= 30 - 15 = 15$

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(a). No. of students who got an A on both subject

$$n(A_1 \cup A_2) = n(A_1) + n(A_2) - n(A_1 \cap A_2)$$
$$15 = 10 + 9 - n(A_1 \cap A_2)$$
$$n(A_1 \cap A_2) = 19 - 15$$
$$= 4$$

(b). No. of students who got A on first but not on both

$$= n(A_1) - n(A_1 \cap A_2)$$
$$= 10 - 4$$
$$= 6$$

(c) No. of students who got an A on second but not the first

$$= n(A_2) - n(A_1 \cap A_2)$$
$$= 9 - 4 = 5$$

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(16) Here the Pigonhole are the five set {1,9}, {2,8}, {3,7}, {4,6}, {5}, Thuse any choice of Six Element (Pigeon) of S will guarantee that the two of the number added up to ten.

(29)
(a) The three area are the Pigeonholes and the student must take five classes (Pigeons); Hence Student must take atleast two classes in one area.

(b) Let each of the 3 area of study represent three disjoint set A, B, C Since the set are disjoint
$n(A \cup B \cup C) = 5 = n(A) + n(B) + n(C)$
Since the student can't take at most two classes in any area of study the sum of classes in any two set say A and B must be less then or equal to four
Hence $5 - [n(A) + n(B)] = n(C) \geq 1$, Thus
Student must take atleast one class in any area

(30) (a) If $2n = 6$: HTHTHT, THTHTH, HTTHTH, HTHTTH
four ways to get 3 adjacent head $n = 3$

(b) if 2n time there is n head
there is one way to toss HTHT ---- HT
And another way to toss THTH --- TH
$\therefore$ $1 + 1 + (n-1) \Rightarrow n+1$

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37) (a) women having 11 close friend and have to invite 5 of them

$\therefore$ There are no restrictions $C(11,5) = {}^{11}C_5$

$$\frac{11!}{5!\,(11-5)!} = \frac{11 \times 10 \times 9 \times 8 \times 7 \times 6!}{5 \times 4 \times 3 \times 2 \times 1\ 6!} = 11 \times 3 \times 2 \times 7$$
$$= 462$$

(c) $C(9,5) + 2C(9,4)$

${}^9C_5 + 2 \cdot {}^9C_4$

when 1 donot attend ${}^9C_4$
when 2 donot attend ${}^9C_4$
when both donot attend ${}^9C_5$

$$\frac{9!}{5!\,(9-5)!} + \frac{2 \cdot 9!}{4!\,(9-4)!}$$

$$\frac{9!}{5! \cdot 4!} + \frac{2 \cdot 9!}{4!\,5!}$$

$$\frac{9 \times 8 \times 7 \times 6 \times 5!}{5! \cdot 4 \times 3 \times 2 \times 1} + \frac{2 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5!}{5! \cdot 4 \times 3 \times 2 \times 1}$$

$\Rightarrow 9 \times 7 \times 2 + 2 \cdot 3 \cdot 7 \cdot 6$

$\Rightarrow 126 + 252$

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(b)

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(39) Consider all integer from 1 up to an incuding 100
$S = \{1, 2, 3, 4, 5 \ldots\ldots 100\}$

(a) Odd = $\{1, 3, 5, 7, 9, 11 \ldots\ldots 99\}$ $\Rightarrow$ 50 no.
Square = $\{\cancel{1^2}, 2^2, \cancel{3^2}, 4^2, \cancel{5^2}, 6^2, \cancel{7^2}, 8^2, \cancel{9^2}, 10^2\}$ $\Rightarrow$ 5 no.

total = 50+5 = 55

(b) Even = $\{2, 4, 6, 8, 10 \ldots\ldots 100\}$ $\Rightarrow$ 50 no.
Cube = $\{1^3, 2^3, 3^3, \cancel{4^3}\}$ $\Rightarrow$ 2 no.

total = 52

(46) $N(A) = 50$
$N(B) = 60$ Each pair Has 20 Element in common
$N(C) = 70$ Each ~~pair~~ ~~Has~~ triple pair has 10 Element Comm
$N(D) = 80$ Each all four Element has 5 Common

~~$N(A\cup B\cup C\cup D) = N(A)+N(B)+N(C)+N(D) - n(A\cup B) - n(A\cup C) - n(A\cup D)$~~
~~$- N(B\cup C) - N(B\cup D) - N(C\cup D) - n(A\cup B\cup C) - n(A\cup B\cup D)$~~
~~$- n(B\cup C\cup D) - n(A\cup C\cup D) - n(A\cup B$~~

$n(A\cup B\cup C) = n(A) + n(B) + n(C) + n(D) - n(A\cap B) - n(A\cap C)$
$- n(A\cap D) - n(B\cap C) - n(B\cap D) - n(C\cap D)$
$- n(A\cap B\cap C) - n(A\cap B\cap D) - n(A\cap C\cap D) - n(B\cap C\cap D)$
$- n(A\cap B\cap C\cap D)$

$= 50+60+70+80 - 6\cdot 20 - 4\cdot 10 - 5$
$= 75$