Rules of inference :-

we have Already proven facts which are true. and using those facts we have to infer new facts.

1. Modus ponen

$$(P \wedge P \rightarrow Q) \rightarrow Q$$

or

$$\begin{array}{l} P \\ P \rightarrow Q \\ \hline \therefore Q \end{array}$$

2. Modus Tollen

$$(\sim Q \wedge P \rightarrow Q) \rightarrow \sim P$$

or

$$\begin{array}{l} \sim Q \\ P \rightarrow Q \\ \hline \therefore \sim P \end{array}$$

$p \wedge q \equiv p$

$p \wedge q \equiv q$

Simplification

Hypothetical syllogism

$p \to q$

$q \to r$

$\therefore p \to r$

Disjunctive syllogism

$\sim p$

$p \vee q$

$\therefore q$

$\sim p \wedge (p \vee q) \to q$

$(\sim p \wedge p) \vee (\sim p \wedge q)$

$F \vee (\sim p \wedge q)$

$(\sim p \wedge q) \to q$

$\sim(\sim p \wedge q) \vee q$

$(p \vee \sim q) \vee q$

$p \vee T = T$

21/12/2020

Counting Techniques:- (Permutation & Combination)

Q. How many passwords can be created of length 8 that contains digits (0-9) and alphabets (a-z A-Z) only?

or How many number of product codes can be generated.

How many IP addresses can be generated of 16 length?

Permutations

$\{a, b, c\}$

1. a b c
2. a c b
3. b a c
4. b c a
5. c a b
6. c b a

6 different passwords can be generated if no object is repeated ie a a a b is ~~not~~ counted here.

problem in listing down by counting.

what happened if there are 5 or more objects a, b, c, d, e?

Permutation problems

Counting objects through change of the positions

IN PERMUTATION : arrangements of objects matters.

password of length = 3 using symbols a, b, c

Repetition is not allowed.

(a, b, c) (b, c)

___ ___ ___

3 choices 2 choices 1 choice

no of password = $3 \times 2 \times 1 = 6$

$= 3!$

Suppose I have three pencils (a, b, c)

cost of any one pencil is 2 Rs

what will be the cost of 3 pencils?

pencil a = 2

pencil b = 2

pencil c = 2

$2+2+2 = 6$

or $3 \times 2 = 6$

Pencils

2Rs

$2 \times 3 = 6$

Pencil

Rs

$a \begin{Bmatrix} b & c \\ c & b \end{Bmatrix}$ 2 ways
2 Rs

$b \begin{Bmatrix} a & c \\ c & a \end{Bmatrix}$ 2 ways

$c \begin{Bmatrix} a & b \\ b & a \end{Bmatrix}$ 2 ways

$3! = \underline{3 \times 2} \times 1$
$6 \times 1 = 6$

$= 3 \times 2$

$2 + 2 + 2 = 6$

1. a b — c 1 Rs 1 way
2. a c — b 1 way
3. b a — c 1 way
4. b c — a 1 way
5. c a — b 1 way
6. c b — a 1 way

1 object $\longrightarrow$ 2 ways
3 objects $\longrightarrow$ $3 \times 2 = 6$ ways
objects — ways

$3 \times 2 \times 1 = 3!$

obj way = 6 objects × 1

6×1

objects way = 6 ways.

4 Different objects (a, b, c, d)

4 objects

a [b c d] 3!

b [a c d] 3!

c [_ _ _] 3!

d _ _ _

4!

d [_ _ _] 3!

3!
+3!
+3!
+3!

$4 \times 3!$

objects ways
= 4!

3! + 3! + 3! + 3!

6 + 6 + 6 + 6 = 24

4 × 6 = 24

$4! = 4 \times \underbrace{3 \times 2 \times 1}$

$= 4 \times 3!$

$4! = 4 \left[\underbrace{\_}_{\text{objects}} \underbrace{(\_ \; \_ \; \_)}_{\text{ways}} \right]$

object

	3	2	1	
1. a	b	c	d	3!
	b	d	c	
	c	b	d	
	c	d	b	
	d	c	b	
	d	b	c	

2. b. [ ]

3. c

4. d

Permutation

Technique 1:- if we have a "n" different objects then they can be arranged themselves in $n!$ ways.

Q1. How many passwords of length 8 can be generated using alphabets (a-z) and digits (0-9) only if repetition is not allowed.?

(10 digits 0 - 9)

a-z = 26

26+10 = 36 objects

$\underline{\ \ }\ \underline{\ \ }\ \underline{\ \ }\ \underline{\ \ }\ \underline{\ \ }\ \underline{\ \ }\ \underline{\ \ }\ \underline{\ \ }$

36 35 34 33 32 31 30 29

choices

$36 \times 35 \times 34 \times 33 \times 32 \times 31 \times 30 \times 29$

Q1 ii) How many password of length 8 if they start with 3 Digits (digits) must followed by alphabets (a – z)

D	D	D	A	A	A	A	A
10	9	8	26	25	24	23	22

$10 \times 9 \times 8 \times 26 \times 25 \times 24 \times 23 \times 22$

= no of passwords.

Q1. 1

iii) Any two specified digits must come together at any position in the password.

for example.

ab 12 c d e f

b 12 a c d e f

67 12 a b c d

67 a b c d 12

count two specified digits as 1 object.

Hence total digits (0 – 9) = 10 – 1 = 9 objects

$\{0, 12, 3, 4, 5, 6, 7, 8, 9\}$

9 digits objects + 26 alphabets

$= 26 + 9 = 35$ objects are to be arrange in 8 positions

$\underline{\quad}$ $\underline{\quad}$ $\underline{\quad}$ $\underline{\quad}$ $\underline{\quad}$ $\underline{\quad}$ $\underline{\quad}$ $\underline{\quad}$

35 34 33 32 31 30 29 28

$= 35 \times 34 \times 33 \times 32 \times 31 \times 30 \times 29 \times 28 =$

shape 1

= no of passwords in which (1,2) ~~occur~~

a (2,1)

shape 2

for shape (1) (1,2) there will ~~ae~~

$*$ no of passwords

for shape (2) (2,1) $*$ no of passwords

total no of password $= * + * = 2*$

total password $= (35 \times 34 \times 33 \times 32 \times 31 \times 30 \times 29 \times 28) \times 2$

Q. How many natural numbers of three different digits can be formed using digits (0, 1, 2, 3, 4, 5) that lies b/w 320 – 445 ?

Solution-

H T U

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