UNIT # 12

PERMUTATION & COMBINATION AND PROBABILITY

PERMUTATION & COMBINATION

EXERCISE - 01 — CHECK YOUR GRASP

1. Total possible words – words do not begin or terminate with vowel

Total words = 5! = 120

Words which do not begin and terminate with vowel

= 3 3 2 1 2 = 36

Desired words : 180 – 36 = 84

II-Method → words which begin with vowel

(A/I) = 4! 2 = 48 ways → say = n(A)

Similarly words terminating with vowel

= 4! 2 = 48 ways → say = n(B)

Now exclude words which begin as well as terminates with vowel

2 3 2 1 1 = 12 ways → n(A ∩ B)

Desired number of words :-

48 + 48 – 12 = 84 ways

($\because$ n(A ∪ B) = n(A) + n(B) – n(A ∩ B))

3. Number of selections of 4 consonants out of 7 is ${}^7C_4$

Number of selections of 2 vowels from 4 is ${}^4C_2$

Arrangement of words in 6! ways

Desired words : ${}^7C_4$ ${}^4C_2$ 6! = 151200

7. Make cases when all 5 boxes are filled by:

Case 1 : identical 5 red balls

${}^5C_5$ → 1 way

Case 2 : 4 identical red balls and 1 blue ball

${}^5C_1$ = 5 ways

Case 3 : 3 blue and 2 red balls i.e. xRxRx

⇒ 4 gaps, for 2 blue balls

$\therefore$ ${}^4C_2$ = 6 ways

Case 4 : 2 red and 3 blue balls i.e. xRxRx⇒ 3 gaps, 3 blue balls

⇒${}^3C_3$ = 1 way

$\therefore$ Total number of ways are 1+5+6+1 = 13 ways

9. EEQUU

Words starting with E → $\frac{4!}{2!}$

Words starting with QE → $\frac{3!}{2!}$

next word will be QUEEU → 1

and finally QUEUE → 1

Rank is 12 + 3 + 1 + 1 = 17th

12. For a number to be divisible by 5,5 or 0 should be at units place.

$\therefore$ Unit place can be filled by 2 ways

Remaining digits can be filled in $\frac{6!}{3!\times 2!}$ ways.

$\therefore$ Total ways $=\frac{2\times 6!}{3!2!}$

But these arrangements also include cases where 0 is at millions place and 5 at units place, which are undesirable cases

⇒ $\frac{5!}{3!\times 2!}$ ways (undesirable)

subtract it from total ways.

$\therefore$ Desired ways = 2 $\frac{6!}{3!\times 2!}$ – $\frac{5!}{3!\times 2!}$ = 110

EXERCISE - 02 — BRAIN TEASERS

1. I_H → Indian husband, I_W → Indian wife

A_H → American husband, A_W → American wife

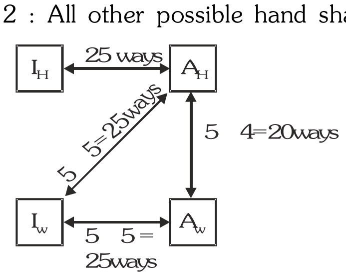
Case 1 : Hand shaking occuring between same nationals and same genders (M/F)

$I_H - I_H$ → ${}^5C_2$ = 10 ways

Similarly for $I_W - I_W$, $A_W - A_W$, $A_H - A_H$

Total ways 10 4 = 40.

Case 2 : All other possible hand shakes



Hence total number of handshakes

= (25 3 + 40) + (20) = 135

Method-II

Total number of handshakes possible ${}^{20}C_2$

undesirable handshakes : ${}^{10}C_2$ + ${}^{10}C_1$

Hence, Desired ways = ${}^{20}C_2$ –(${}^{10}C_2$ + ${}^{10}C_1$)

3. **Case 1 :** When all n red balls are taken but no green ball.

Only 1 arrangement is possible.

Case 2 : n red balls and 1 green balls

Number of arrangement = $\frac{\lfloor n+1}{\lfloor n \lfloor 1}$

Case 3 : n red balls and 2 green balls

Number of arrangement = $\frac{\lfloor n+2}{\lfloor n \lfloor 2}$

case m + 1 : n red balls and m green balls

Number of arrangements = $\frac{\lfloor n+m}{\lfloor n \lfloor m}$

add all cases

$1 + \frac{\lfloor n+1}{\lfloor n \lfloor 1} + \frac{\lfloor n+2}{\lfloor n \lfloor 2} + \ldots\ldots\ldots\ldots + \frac{\lfloor n+m}{\lfloor n \lfloor m}$

${}^{n+1}C_0 + {}^{n+1}C_1 + {}^{n+2}C_2 + \ldots\ldots\ldots\ldots + {}^{n+m}C_m$

${}^{n+2}C_1 + {}^{n+2}C_2 + \ldots\ldots\ldots\ldots + {}^{n+m}C_m$

$(\therefore {}^{n}C_r + {}^{n}C_{r-1} = {}^{n+1}C_r)$

${}^{n+3}C_2 + {}^{n+3}C_3 + \ldots\ldots\ldots\ldots + {}^{n+m}C_m$

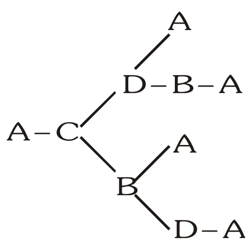
Finally we get the sum as : ${}^{m+n+1}C_m$

5. Maximum number of matches possible, if India win the series are 9

Out of these 9 matches we are required to choose 5 matches that India may win :

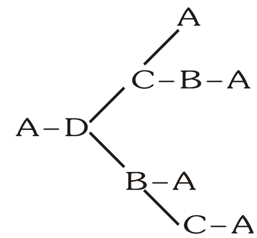
$\Rightarrow$ Total ways : ${}^{9}C_5$

6. Paths are shown as :-



4 paths

Similarly if we start from A towards B we get another 4 paths.



Similarly if we start from A towards B

Again 4 paths

$\therefore$ Total different paths = 4 3 = 12

II Method $\rightarrow$ ${}^{3}C_1$ ${}^{2}C_1$ ${}^{2}C_1$ = 12

7. Case 1 : Mr. B & Miss C are in committee and Mr. A is excluded

$\Rightarrow$ ${}^{4}C_2$ ${}^{4}C_1$ = 24 ways
(Men) (Women)

Case 2 : Mr. B not there : ${}^{5}C_3$ ${}^{5}C_2$ = 100 ways
(Men) (Women)

Total ways = 24 + 100 = 124

EXERCISE - 03 — MISCELLANEOUS TYPE QUESTIONS

Match the column :

1. (A) Each box (say B_1, B_2, B_3) will have at least one ball.

Now the ways for placing other 2 identical balls in 3 different boxes are :-

$$\frac{(2+3-1)!}{2!\,(3-1)!} = 6 \quad \left(\therefore \frac{(n+r-1)!}{n!\,(r-1)!}\right)$$

(B) **Case 1** : 5 balls can be divided in 3 groups having 2 balls each in 2 boxes and 1 ball for in third box (2, 2, 1)

$$\text{ways : } \frac{5!}{(1!)(2!)^2 \times 2!} = 15$$

Case 2 : Division can also be 3 in one box and 1 each in remaining 2 boxes (3, 1, 1)

$$\text{ways : } \frac{5!}{3! \times (1!)^2 \times 2!} = 10$$

Hence total ways = 10 + 15 = 25

(C) Only 2 arrangements are possible.

(1) 2 balls each in 2 boxes & remaining ball in other box (2, 2, 1)

(2) 3 balls in 1 box and 1 ball each in other boxes (3, 1, 1)

(D) Same cases as that of in part B with arrangements.

Comprehension # 02

1. Exponent of 7 in 100! –

$$\left[\frac{100}{7}\right] + \left[\frac{14}{7}\right] = 14 + 2 = 16$$

exponent of 7 in 50!

$$\left[\frac{50}{7}\right] + \left[\frac{7}{7}\right] = 8$$

$$\text{Exponent of 7 in } {}^{100}C_{50} = \frac{100!}{50!50!} = \frac{7^{16}}{7^8 7^8} = 7^0$$

$\therefore$ exponent of 7 will be 0.

2. Product of 5's & 2's constitute 0's at the end of a number $\Rightarrow$ No. of 0's in 108!

= exponent of 5 in 108!

(Note that exponent of 2 will be more than exponent of 5 in 108 !)

$$\Rightarrow \left[\frac{108}{5}\right] + \left[\frac{21}{5}\right] = 21 + 4 = 25$$

3. As $12 = 2^2.3$, here we have to calculate exponent of 2 and exponent of 3 in 100!

exponent of 2

$$= \left[\frac{100}{2}\right] + \left[\frac{50}{2}\right] + \left[\frac{25}{2}\right] + \left[\frac{12}{2}\right] + \left[\frac{6}{2}\right] + \left[\frac{3}{2}\right] = 97$$

$$\text{exponent of 3} = \left[\frac{100}{3}\right] + \left[\frac{33}{3}\right] + \left[\frac{11}{3}\right] + \left[\frac{3}{3}\right] = 48$$

Now, 12 = 2 2 3

we require two 2's & one 3

$\therefore$ exponent of 3 will give us the exponent of 12 in 100! i.e. 48

EXERCISE - 04[A] CONCEPTUAL SUBJECTIVE EXERCISE

2. Selecting 3 horses out of ABC A'B'C' is ${}^6C_3$ ways

When AA' is always selected among (ABC A'B'C')

Remaining (BB'CC') can be selected in ${}^4C_1$ ways similarly, when BB' and CC' is selected

$\therefore$ Undesirable ways will be $({}^4C_1)\quad 3$

using, total ways–undesirable ways = desired ways we get

$({}^6C_3 - ({}^4C_1)3) \rightarrow$ This is selection of 3 horses among (ABC A'B'C') under given condition.

Remaining 3 can be selected in ${}^{10}C_3$ ways.

Hence, desired ways will be $[{}^6C_3 - {}^4C_1 \quad 3]{}^{10}C_3 = 792$

Method II : Select one horse each from AA', BB' and CC' hence ${}^2C_1 \quad {}^2C_1 \quad {}^2C_1$ ways. Now select 3 horses from remaining 10 horses in ${}^{10}C_3$ ways. Total ways = ${}^{10}C_3 \quad {}^2C_1 \quad {}^2C_1 \quad {}^2C_1$

3. **Case 1 :** When all digits are same : ${}^9C_1$ (excluding 0)

Case 2 : When digits are different and 0 excluded.

(a) Selecting 2 numbers in ${}^9C_2$ ways

(b) Each digit can be filled in 2 ways hence $2 \quad 2 \quad 2 \quad 2 = 2^4$ way

(c) Undesirable case : when a particular digit is same ($2 \quad 1 = 2$ ways) (case 1)

$\therefore$ ${}^9C_2\ (2^4 - 2)$ ways

Case 3 : When digits are different and 0 is included

(a) other digit can be chosen in ${}^9C_1$ ways

(b) 0 can't be placed at ten thousand's place, hence selected digit should be fixed at this place remaining 3 digits can be filled with $2 \quad 2 \quad 2 = 2^3$ ways.

(c) Undesirable case : When all the 4 digits gets filled with selected digit only (0 not included) = 1 way

hence no. of ways will be : ${}^9C_1\ (2^3 - 1)$

$\therefore$ Total desired ways :- ${}^9C_1 + {}^9C_2(2^4 - 2) + {}^9C_1\ (2^3 - 1) = 576$ ways

7. Husband – H, Wife – W

Given :

Relatives of husband (H) (a) Ladies $(L_H) = 4$

(b) Gentlemen $(G_H) = 3$

Relatives of Wife (W) (a) Ladies $(L_W) = 3$

(b) Gentlemen $(G_W) = 4$

Case 1 : Selecting $(3L_H)$ and $3(G_W)$

ways : ${}^4C_3 \quad {}^4C_3 = 16$

Case 2 : Selecting $(3G_H)$ and $3(L_W)$

ways : ${}^3C_3 \quad {}^3C_3 = 1$

Case 3 : Selecting ($2L_H$ & $1G_H$) & ($1L_w$ & $2G_w$)

ways : ${}^4C_2 \quad {}^3C_1 \quad {}^3C_1 \quad {}^4C_2 = 324$

Case 4 : Selecting ($1L_H$ & $2G_H$) & ($2L_W$ & $1G_w$)

ways : ${}^4C_1 \quad {}^3C_2 \quad {}^3C_2 \quad {}^4C_1 = 144$

Add all cases we get : 485 ways

8. Step 1st : Arrange 5 boys in 5! ways

Step 2nd : Select 2 gaps from 6 gaps for 4 girls (2girls for each gap) in ${}^6C_2$ ways.

Step 3rd : Select 2 girls to sit in one of the gaps and other 2 in remaining selected gaps = ${}^4C_2$ ways

Step 4 : Arrange 1st, 2 girls in 2! and other 2 in 2! ways

Hence, total ways $\rightarrow 5! \quad {}^6C_2 \quad {}^4C_2 \quad 2 \quad 2 = 43200$

13. Distribute 15 candies among.

Ram (R) + Shyam(S) + Ghanshyam(G) + Balram(B)

with condition given : $R+S+G+B=15$ & $R \leq 5$ & $S \geq 2$

After giving 2 to Shyam, remaining candies 15–2=13

Now distribute 13 candies in

$$\text{R, S, G, B in } \frac{\lfloor 13+4-1}{\lfloor 13 . \lfloor 3} = {}^{16}C_3 \text{ ways}$$

In ${}^{16}C_3$ ways, we have to remove undesirable ways, when $R > 5$

Undesirable ways : $R > 5 \Rightarrow R \geq 6$

give at least 6 to R and 2 to S and distribute remaining between R, S, G, B

15 – (2 + 6) = 7 remaining can be distributed

$$\text{between R, S, G, B in } = \frac{\lfloor 7+4-1}{\lfloor 7 . \lfloor 4-1} = {}^{10}C_3 \text{ ways}$$

${}^{10}C_3$ are the undesirable cases

Desired ways = ${}^{16}C_3 - {}^{10}C_3 = 440$

18. Total number of ways = Put exactly one ball in its box and then dearrange remaining balls.

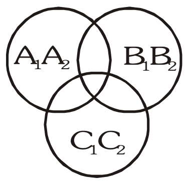
$$= {}^5C_1 \quad 4!\left[1 - \frac{1}{1!} + \frac{1}{2!} - \frac{1}{3!} + \frac{1}{4!}\right] = 5 \quad 9 = 45$$

3. (i) Total ways = 10!

undesirable cases : when 2 Americans are together (A_1A_2)

or two British are together (B_1B_2) or two Chinese are together (C_1C_2)

we plot them on Venn diagram :



we use,

$n(A_1A_2 \cup B_1B_2 \cup C_1C_2) = n(A_1A_2) + n(B_1B_2)$

$+ n(C_1C_2) - n[(A_1A_2) \cup (B_1B_2)]$

$- n[(B_1B_2) \cup (C_1C_2)] - n[(C_1C_2) \cup (A_1A_2)]$

$+ n[(A_1A_2) \cap (B_1B_2) \cap (C_1C_2)]$

where $n(A_1A_2)$ denotes $\rightarrow$ when 2 Americans are together = 9! 2!

correspondingly for $B_1B_2 \& C_1C_2$

$n[(A_1A_2) \cup (B_1B_2)]$ denotes when 2 Americans and 2 Britishmen are together

= 8! 2! 2!

correspondingly same for others.

$n[(A_1A_2) \cap (B_1B_2) \cap (C_1C_2)]$ denotes when 2 Americans, 2 Britishmen and 2 Chinese are together = 7! 2! 2! 2! = 86

Put values we get

$n(A_1A_2 \cup B_1B_2 \cup C_1C_2)$

= 9! 2! 3 – 8! 2 2 3 + 8!

= 8!(43)

These are undesired ways

Desired ways = 10! – 8! (43) = 8!(47)

(ii) Now they are on a round table

Total ways = (n – 1) ! = (10 – 1) ! = 9 !

Undesired ways :

$n(A_1A_2 \cup B_1B_2 \cup C_1C_2)$

= 8! 2! 3 – 7! 2! 2! 3 + 6! 2! 2! 2!

= 6! 4 [7 2 2 3 – 7 3 + 2]

= 6! 260

Desired ways = 9! – 6! 260

= (244) 6! ways

6. (a) Selection of r things out of n +1 different things = Selection of r things out of n +1 different things, when a particular thing is excluded + a particular thing is included.

(b) Selection of r things out of not m + n different things can be made by selecting x thing from m and y thing from such that x +y = r

& (x, y) = (0, r), (1, r – 1), (2, r – 2), ...(r, 0)

9. 2 clerks who prefer Bombay are to be sent to 2 different companies in Bombay,

and Out of remaining 5 clerks (excluding 3 clerks who prefer for outside) 2 clerks are chosen in ${}^5C_2$ ways.

Now these 4 can be sent to 2 different companies into 2 groups of 2 each in ${}^4C_2$ ways

$\Rightarrow {}^5C_2 \quad {}^4C_2$

Now for outside companies we have 6 clerks remaining we select them as (2 for each company)

${}^6C_2 \quad {}^4C_2 \quad {}^2C_2$

Desired ways = $({}^5C_2 \quad {}^4C_2)\ ({}^6C_2 \quad {}^4C_2 \quad {}^2C_2)$ = 5400 ways.

11. Total cases of selecting 8 men out of 11 is ${}^{11}C_8$

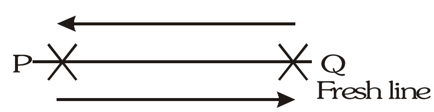
Undesirable case : When all the 5 men, who can only row on stroke side are selected then other 3 men can be selected in ${}^6C_3$ ways.

Hence, ${}^{11}C_8 - {}^6C_3 = 145$ Ans.

12. Step 1st : Select 2 lines out of n lines in ${}^nC_2$ ways to get a point (say p).

Step-2nd : Now select another 2 lines in ${}^{n-2}C_2$ ways, to get another point (say Q)

Step-3rd : When P and Q are joined we get a fresh line.



But when we select P first then Q and Q first then P we get same line.

$\therefore \dfrac{{}^nC_2 \times {}^{n-2}C_2}{2}$ Fresh lines

EXERCISE - 05 [A] JEE-[MAIN] : PREVIOUS YEAR QUESTIONS

1. Numbers greater than 1000 and less than or equal to 4000 will be of 4 digits and will have either 1 (except 1000) or 2 or 3 in the first place with 0 in each of the remaining places.

After fixing 1st place, the second place can be filled by any of the 5 numbers. Similarly third place can be filled up in 5 ways and 4th place can be filled up in 5 ways. Thus there will be 5 5 5 = 125 ways in which 1 will be in first place but this include 1000 also hence there will be 124 numbers having 1 in the first place. Similarly 125 for each 2 or 3. One number will be in which 4 in the first place and i.e. 4000. Hence the required numbers are 124 + 125 + 125 + 1 = 375 ways.

2. We know that a five digit number is divisible by 3, if and only if sum of its digits (= 15) is divisible by 3. Therefore we should not use 0 or 3 while forming the five digit numbers. Now, (i) in case we do not use 0 the five digit number can be formed (from the digit 1, 2, 3, 4, 5) in ${}^5P_5$ ways.

(ii) In case we do not use 3, the five digit number can be formed (from the digit 0, 1, 2, 4, 5) in ${}^5P_5 - {}^4P_4 = 5! - 4! = 120 - 24 = 96$ ways.

$\therefore$ The total number of such 5 digit number $= {}^5P_5 + ({}^5P_5 - {}^4P_4) = 120 + 96 = 216$

4. No. of ways in which 6 men can be arranged at a round table = (6 – 1)!

Now women can be arranged in 6! ways.

Total Number of ways = 6! 5!

5. As for given question two cases are possible

(i) Selecting 4 out of first 5 question and 6 out of remaining 8 questions = ${}^5C_4$ ${}^8C_6$ = 140 choices

(ii) Selecting 5 out of first 5 questions and 5 out of remaining 8 questions = ${}^5C_5$ ${}^8C_5$ = 56 choices.

$\therefore$ Total no. of choices = 140 + 56 = 196

7. Number of ways to arrange in which vowels are in alphabetical order = $\frac{6!}{2!}$ = 360

8. Number of ways = ${}^{n-1}C_{r-1} = {}^{8-1}C_{3-1} = {}^7C_2 = 21$

11. ${}^{10}C_1 + {}^{10}C_2 + {}^{10}C_3 + {}^{10}C_4 = 385$

12. Number of ways = $\frac{12!}{(4!)^3.3!}$ 3! = $\frac{12!}{(4!)^3}$

14. The no. of ways to select 4 novels & 1 dictionary from 6 different novels & 3 different dictionary are ${}^6C_4$ ${}^3C_1$

and to arrange these things in shelf so that dictionary is always in middle _ _ D _ _ are 4!

Required No. of ways ${}^6C_4$ ${}^3C_1$ 4! = 1080

15. Urn A $\rightarrow$ 3 Red balls

Urn B $\rightarrow$ 9 Blue balls

So the number of ways = selection of 2 balls from urn A & B each.

$= {}^3C_2 . {}^9C_2 = 108$

16. $B_1 + B_2 + B_3 + B_4 = 10$

St - 1 : $B_1 \geq 1,\ B_2 \geq 1,\ B_3 \geq 1,\ B_4 \geq 1$

so no. of negative integers solution of equation

$x_1 + x_2 + x_3 + x_4 = 10 - 4 = 6$

${}^{6+4-1}C_{4-1} = {}^9C_3$

St - 2 : selction of 3 places from out of 9 places = ${}^9C_3$

Both statements are true and correct explaination

17. $N = {}^{10}C_3 - {}^6C_3 = \frac{10\times9\times8}{3\times2\times1} - \frac{6\times5\times4}{3\times2\times1}$

$= 120 - 20 = 100$

$N \leq 100$

18. $W^{10},\ G^9,\ B^7$

selection of one or more balls

= (10 + 1) (9 + 1) (7 + 1) – 1

= 11 10 8 – 1 = 879

19. (A, B)

↑ ↑

2 4 = 8

${}^8C_3 + {}^8C_4 + ... + {}^8C_8 = 2^8 - {}^8C_0 - {}^8C_1 - {}^8C_2$

= 256 – 37 = 219

20. $T_n = {}^nC_3 \Rightarrow {}^{n+1}C_3 - {}^nC_3 = 10$

(n + 1) n (n – 1) – n(n – 1) (n – 2) = 60

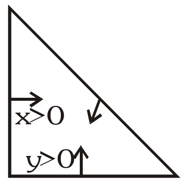
n(n – 1) = 20

n = 5

4. $x + y < 21$

$x + y \le 20$

$x + y \le 18$ ($\because x > 0$ & $y > 0$)



Introducing new variable t

$x + y + t = 18$

Now dividing 18 identical things among 3 persons.

$= {}^{18+3-1}C_{3-1} = \dfrac{\lfloor 18+3-1}{\lfloor 18 \lfloor 3-1} = 190$

5. Total number of ways of distributing n^2 objects into n groups, each containing n objects

$= \dfrac{(n^2)!}{(n!)^n n!}.n! = \dfrac{(n^2)!}{(n!)^n} =$ integer

(Since number of ways are always integer)

8. Since, r, s, t are prime numbers.

$\therefore$ Selection of p and q are as under

p	q	number of ways
r^0	r^2	1 way
r^1	r^2	1 way
r^2	r^0, r^1, r^2	3 ways

$\therefore$ Total number of ways to select r = 5

s^0	s^4	1 way
s^1	s^4	1 way
s^2	s^4	1 way
s^3	s^4	1 way
s^4	s^0, s^1, s^2, s^3, s^4	5 ways

$\therefore$ Total number of ways to select s = 9.

Similarly total number of ways to select t = 5

number of ways = 5 9 5 = 225.

11. **Ans. (D)**

Case- I : The number of elements in the pairs can be 1,1; 1,2; 1,3,; 2,2

$= {}^4C_2 + {}^4C_1 \quad {}^3C_2 + {}^4C_1 \quad {}^3C_3 + \dfrac{{}^4C_2.{}^2C_2}{2} = 25$

Case- II : Number of pairs with ϕ as one of subsets $= 2^4 = 16$

$\therefore$ Total pairs = 25 + 16 = 41

12 Balls can be distributed as 1, 1, 3 or 1, 2, 2 to each person.

When 1, 1, 3 balls are distributed to each person, then total number of ways :

$= \dfrac{5!}{1!\,1!\,3!}.\dfrac{1}{2!}.3! = 60$

When 1, 2, 2 balls are distributed to each person, then total number of ways :

$= \dfrac{5!}{1!\,2!\,2!}.\dfrac{1}{2!}.3! = 90$

$\therefore$ total = 60 + 90 = 150

Paragraph for Question 13 and 14 :

For a_n

The first digit should be 1

For b_n

$\underbrace{1\_\_\_\_\_\ldots\_\_1}_{(n-2\text{ Places})}$

Last digit is 1. so b_n is equal to number of ways of a_{n-1} (i.e. remaining (n – 1) places)

$b_n = a_{n-1}$

For c_n

Last digit is 0 so second last digit must be 1

So $c_n = a_{n-2}$

$b_n + c_n = a_n$

So $a_n = a_{n-1} + a_{n-2}$

Similarly $b_n = b_{n-1} + b_{n-2}$

13. **Ans.(B)**

$a_1 = 1,\ a_2 = 2$

So $a_3 = 3,\quad a_4 = 5\ \ a_5 = 8$

$\Rightarrow b_6 = a_5 = 8$

14. **Ans.(A)**

$a_n = a_{n-1} + a_{n-2}$

put n = 17

$a_{17} = a_{16} + a_{15}$ (A) is correct

$c_n = c_{n-1} + c_{n-2}$

So put n = 17

$c_{17} = c_{16} + c_{15}$ (B) is incorrect

$b_n = b_{n-1} + b_{n-2}$

put n = 17

$b_{17} = b_{16} + b_{15}$ (C) is incorrect

$a_{17} = a_{16} + a_{15}$

while (D) says $a_{17} = a_{15} + a_{15}$ (D) is incorrect