ULTIMATE KCET

CRASH COURSE 2026

Mathematics | Lecture – 01

Permutations

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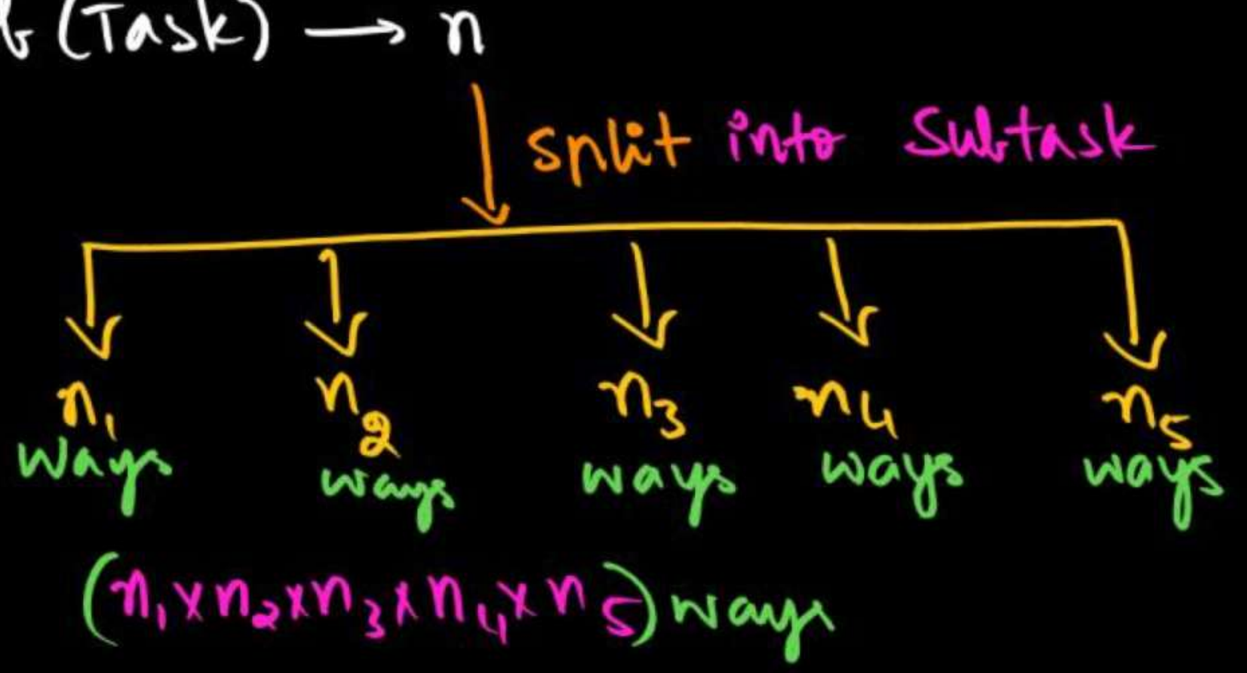
Topics to be covered

1. Counting Poinciple
2. Permutations
3.
4.



Multiplication Principle:- If you are asked to perform a task & the task is divided into $n_1, n_2, n_3, \ldots n_n$ sub tasks, performing all these tasks independently completes the main task.

∴ No of ways in which the main task can be completed is $n_1 \times n_2 \times n_3 \times \ldots \times n_n$

QUESTION

main task

#Q. The number of six digit numbers, whose all digits are odd (i.e., 1, 3, 5, 7, 9), is

Here no condition is given ⇒ we assume repitition of digits are allowed

A 6^5

B ✓ 5^6

C $6!/2!$

D 5^5

5 ways _5_ _5_ _5_ _5_ _5_ $= 5^6$

options are (1,3,5,7,9)

QUESTION

$1000 < x \leq 4000$

4 digit no.

#Q. The number of numbers greater than 1000, but not greater than 4000 that can be formed with the digits 0, 1, 2, 3, 4, if repetition of digits being allowed, is

4

A 372

B 374

C 375

D 376

3 ways → options (0, 2, 3)

5 ways → options (0, 1, 2, 3, 4)

5 ways → options (0, 1, 2, 3, 4)

5 ways

$= 3 \times 5^3$

$= 3 \times 125$

$= 375$

Remove 1000 = 375 − 1 = 374

Consider 4000 = 374 + 1

= 375

3 Black
2 White

Pick a Ball
such that one is Black & one is White

Here the same job can
be done in different ways

1st way → 1st Black & Then white
+ (or)
2nd way → 1st white & Then Black

But order is not given

ie, which Ball to be Picked
first is not given

QUESTION

#Q. The number of positive integers, which can be formed by using any number of digits 0, 1, 2, 3, 4, 5 using each digit not more than once in each number, is

repetition is not allowed

+ve integers

1 digit or 2 digit or 3 digit or 4 digit or 5 digit or 6 digit

A 1600

1 digit → 5 ways (options are 1, 2, 3, 4, 5)

B 1620

2 digit → 5 ways (options are 1, 2, 3, 4, 5) × 5 ways = 25 ways

C ✓ 1630

we are left with only 4 options & a zero

D 1720

3 digit → $\underline{5}$ × $\underline{5}$ × $\underline{4}$ = 100

5 options (1, 2, 3, 4, 5)

4 members & zero

4 members

4 digit ⇒ 5 × 5 × 4 × 3 = 300

5 digit → 5 × 5 × 4 × 3 × 2 = 600

6 digit → 5 × 5 × 4 × 3 × 2 × 1 = 600

Total

5
25
100
300
600
600

1630

QUESTION

$x > 3000$

↓ 4 digit, 5 digit, 6 digit

#Q. The number of numbers greater than 3000, which can be formed by using the digits 0, 1, 2, 3, 4, 5 without repetition, is

A 1240

B 1280

C 1320

D ✓ 1380

4 digit → $\underline{3}\ \underline{5}\ \underline{4}\ \underline{3} = 180$

↓ options (3, 4, 5)

5 digit → $\underline{5}\ \underline{5}\ \underline{4}\ \underline{3}\ \underline{2} = 600$

↓ options (1, 2, 3, 4, 5)

6 digit → $\underline{5}\ \underline{5}\ \underline{4}\ \underline{3}\ \underline{2}\ \underline{1} = 600$

$\underline{5}$ ⇓ options (1, 2, 3, 4, 5)

Total = 180 + 600 + 600 = 1380

QUESTION

no condition is given → Repetition is allowed

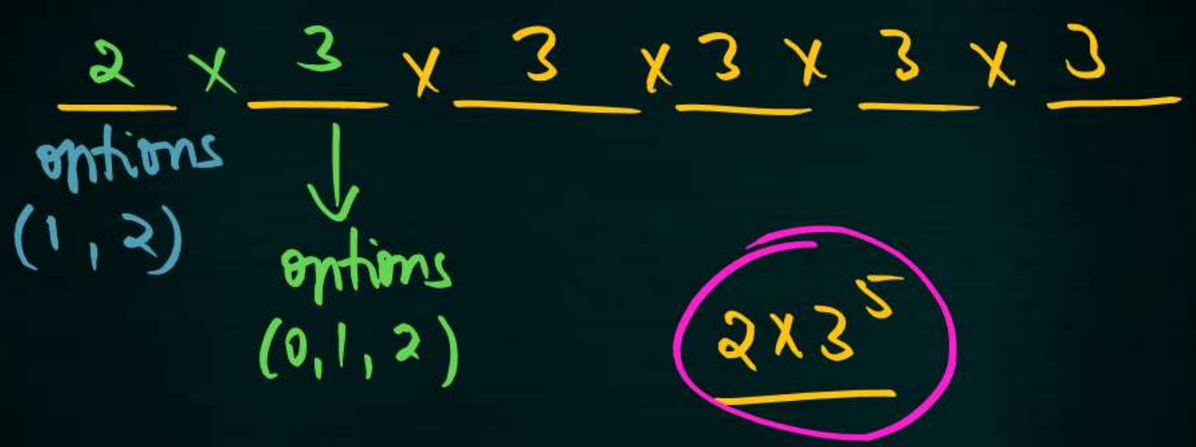
#Q. The number of 6-digit numbers that can be formed using the three digits 0, 1 and 2 is

A 3^6

B 2×3^5

C 3^5

D 6^5



QUESTION

$x < 1000$

3 digit no, 2 digit no, Single digit no

#Q. How many odd numbers less than 1000 can be formed using the digits 0, 1, 4, 5, 7, 8 if the repetition of digits is allowed?

A 96

B 108

C 120

D 150

3 digit → 5 × 6 × 3 = 90

5 options (1, 4, 5, 7, 8)

6 options (0, 1, 4, 5, 7, 8)

3 options (1, 5, 7)

2 digit = 5 × 3

5 options (1, 4, 5, 7, 8)

3 options (1, 5, 7)

= 15

one digit → 3 (options 1, 5, 7)

Total = 90
15
3
108

QUESTION

$6000 < 2 < 7000$
↳ 4 digit

#Q. Find the number of positive integers greater than 6000 and less than 7000 which are divisible by 5, provided that no digit is to be repeated.

A 120

B 100

C ✓ 112

D 110

Here options of nos to be considered is not given

⇒ we consider digits from 0 to 9

$$\underset{\downarrow}{1} \times 7 \times 8 \times \underbrace{2}_{\text{options}} = 112$$

1 option (6)

2 options (0, 5)

atleast means → minimum

QUESTION

#Q. Find the number of different signals that can be generated by arranging at least 1 flags in order (one below the other) on a vertical staff, if five different flags are available

A 312

B 313

C 315

D ✓325

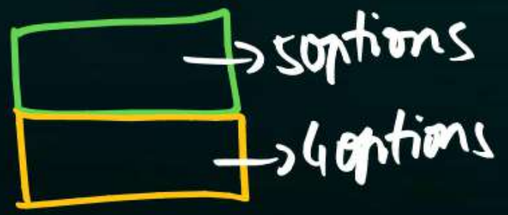
Flag with 1 colour → 5 ways

(or) Flag with 2 colours → 5x4 ways

(or) Flag with 3 colours → 5x4x3

(or) Flag with 4 colours → 5x4x3x2

(or) Flag with 5 colours → 5x4x3x2x1



$5 + 20 + 60 + 120 + 120 = 325$

QUESTION

HW

#Q. How many 4-digit numbers can be formed by using the digits 1 to 9 if repetition of digits is not allowed?

A 3024

B 3026

C 3040

D 3014

$9 \times 8 \times 7 \times 6$

$= 72 \times 42$

$= 3024$

(*) Permutations when objects are repeated :-

if Given n objects

if 1^{st} object repeats k_1 times

if 2^{nd} object repeat k_2 times

if 3^{rd} objects repeat k_3 times

⋮

if p^{th} object repeats k_p times

Then no of permutations

$$= \frac{n!}{k_1!\, k_2!\, k_3! \cdots k_n!}$$

(*) Find the no of Permutations of the word MISSISSIPPI

MISSISSIPPI

M I S P
I S P
I S
I S
I S

$n = 11$

The letter I repeats 4 times

— " — S — " — 4 times

— " — P — " — 2 times

Total permutations

$$= \frac{11!}{4!\,4!\,2!}$$

QUESTION

#Q. In how many ways can the letters of the word PERMUTATIONS be arranged, if the words start with P and end with S?

PERMUTATIONS

T

A 1814400

B 1814405

C 1824050

D 19900

P _ _ _ _ _ _ _ _ _ S

Fix Fix

no of Permutations = $\frac{10!}{2!}$

$10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3$

$= 90 \times 56 \times 30 \times 12$

$= 2700 \times 672$

$n = 12$

$\because$ here T repeats 2 times

$\rightarrow$ remove P & S

$\therefore n = 10$

672 x 27

4704

1344

18144

⇓

772 x 2700

1814400

QUESTION

#Q. The letters of word ZENITH are written in all possible ways. If all these words are written out as in a dictionary, then find the rank of the word ZENITH.

A. 614

B. 616

C. 714

D. 716

No of words starting with Letter E ⇒ E _ _ _ _ _

5 × 4 × 3 × 2 × 1

E → Fixed

5 → 120 ways

This is similar to words starting with

H → 120 ways

I → 120 ways

N → 120 ways

T → 120 ways

ZENITH

⇓ order

E

H

I

N

T

Z

No. of words starting with

2 E H _ _ _ = 6 ways
Fix — 3 × 2 × 1

2 E I _ _ _ = 6 ways
Fix — 3 × 2 × 1

2 E N H _ _ = 2 ways
Fixed — 2 × 1

2 E N I H T → 1 ways

2 E N I T H → 1 ways

E
H _
I
N
T _
Z

Total 600

6

6

2

1

1

616

QUESTION

$(60+3)24$

$1440+72 = 1512$

#Q. Number of different permutations, each containing all letters of the word "STATESMAN" is

S T A E M N

S T A

$n=9$

$$\frac{9!}{2!\,2!\,2!}$$

$$= \frac{9\times\cancel{8}\times7\times6\times5\times4\times3\times2\times1}{\cancel{8}}$$

$= 63\times30\times24$

$= 30\times1512$

$= 45360$

A 90720

B 45360

C 22680

D 34560

QUESTION

#Q. The letters of the word COCHIN are permuted and all the permutations are arranged in alphabetical order as in English dictionary. The number of words that appear before the word COCHIN is

A 360

B 192

C 96

D 48

C C _ _ _ _

Fix

$4 \times 3 \times 2 \times 1 = 24$

C H _ _ _ _

Fix

$4 \times 3 \times 2 \times 1 = 24$

C I _ _ _ _

Fix

$4 \times 3 \times 2 \times 1 = 24$

C
C
H
I
N
O

C N Fix

_ _ _ _
4 × 3 × 2 × 1 = 24

C O C H I N → 1 way

COCHIN is 24+24+24+24+1
= 97th word

∴ words before cochin = 96.

C
C
H
I
N
O

QUESTION

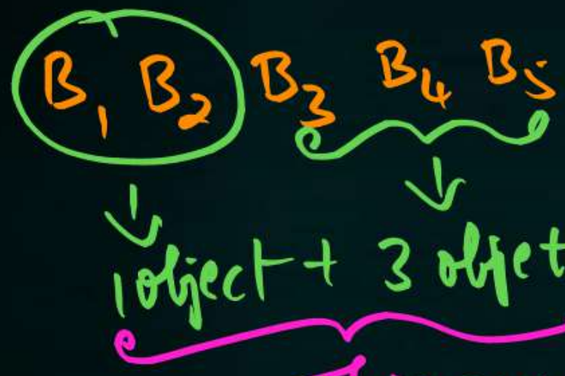
#Q. In how many ways can 5 children be arranged in a line such that two particular children are always together?

A 47

B 50

C ✓ 48

D 49



This can be arranged in $4_{P_4} = 4! = 24$ ways

& B_1 & B_2 can be arranged in 2 ways

Total permutations $= 4! \times 2 = 48$ ways.

QUESTION

LB → Letter Box

#Q. The number of ways in which we can put 5 letters in 10 letter boxes is

LB 1 | LB 2 | LB 3 | LB 4 | .. .. .. | LB 10

A 50

B 5^{10}

C ✓ 10^5

D 500

5 letters ⟶ 1st letter can be placed in any one of 10 Boxes

No of options available = 10

Similarly each letters have got 10 options

10 10 10 10 10 = 10^5

QUESTION

#Q. If ${}^{12}P_r = {}^{11}P_6 + 6.\ {}^{11}P_5$, then $r =$

A 7

B 5

C 6

D 4

$$\frac{12!}{(12-r)!} = \frac{11!}{5!} + 6\,\frac{11!}{6!}$$

$$= \frac{11!}{5!} + \cancel{6}\,\frac{11!}{\cancel{6}\times 5!}$$

$$\frac{12\times\cancel{11!}}{(12-r)!} = 2\left(\frac{\cancel{11!}}{5!}\right)$$

$$\frac{12}{(12-r)!} = \frac{2}{5!}$$

$${}^{n}P_r = \frac{n!}{(n-r)!}$$

$\rightarrow n! = n(n-1)(n-2)(n-3)\ldots 1$

$\rightarrow (n-r)! = (n-r)[n-(r+1)][n-(r+2)]\ldots 1$

$= (n-r)[n-r-1][n-r-2]\ldots 1$

$$\frac{12^{6}}{(12-n)!} = \frac{n}{5!}$$

$$(12-n)! = 6 \times 5!$$

$$= 6!$$

$$(12-n)! = 6!$$

$$12-n = 6$$

$$\boxed{n = 6}$$

QUESTION

#Q. If ${}^nP_4 = 5({}^nP_3)$, then the value of n is equal to

A 5

B 6

C 7

D 8

$$\frac{n!}{(n-4)!} = 5\,\frac{n!}{(n-3)!}$$

$$(n-3)! = 5\,(n-4)!$$

$$(n-3)(n-4)! = 5(n-4)!$$

$$n-3 = 5$$

$$n = 8$$

$$(n-3)! = (n-3)(n-4)(n-5)\ldots 1$$

$$(n-3)! = (n-3)\,(n-4)!$$

QUESTION

#Q. The number of ways in which 5 boys & 3 girls can sit in a row so that no two girls come together is

btw every 2 girls there should be a boy

A $5!\,{}^6P_3$

B $7!\,{}^8P_5$

C $6!\,{}^7P_3$

D $6!\,{}^6P_3$

$5 \times 4 \times 3 \times 2 \times 1$

$\_ B_1 \_ B_2 \_ B_3 \_ B_4 \_ B_5 \_$

Here Boys can be arranged in $= {}^5P_5 = 5!$ ways.

For girls $\Rightarrow$ $n = 6$ Place, $r = 3$ girls $\Rightarrow {}^6P_3$ ways.

Total $= 5!\,{}^6P_3$.

QUESTION

HW

#Q. The number of words that can be written using all the letters of the word 'IRRATIONAL' is

A $10!/(2!)^3$

B $10!/(2!)^2$

C $10!/2!$

D $10!$

QUESTION

HW

#Q. The number of permutations of the letters of the word ALLAHABAD is

A 7450

B 745

C 7560

D 756

QUESTION

HW

#Q. The number of natural numbers less than 1000, in which no two digits are repeated

A 738

B 792

C 837

D 720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