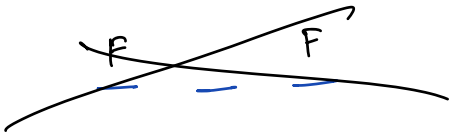
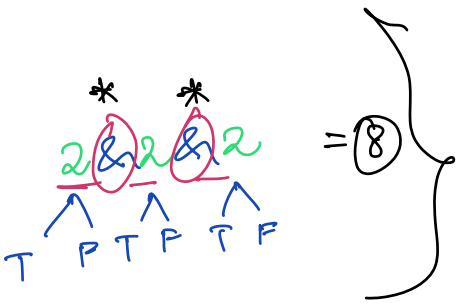
3. Given 3 questions, each question has to be answered either True or False. In how many ways can we answer all the questions?



T T T
T T F
T F T
T F F
F T T
F T F
F F T
F F F

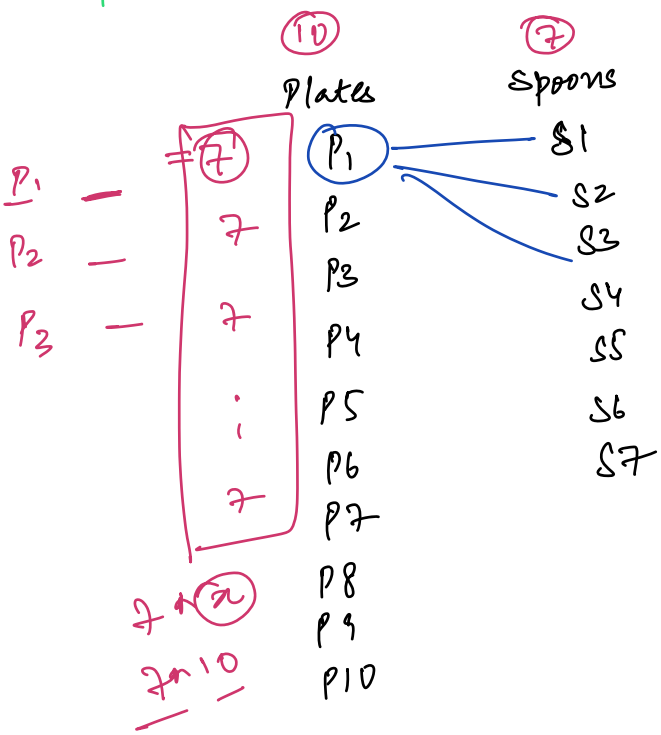


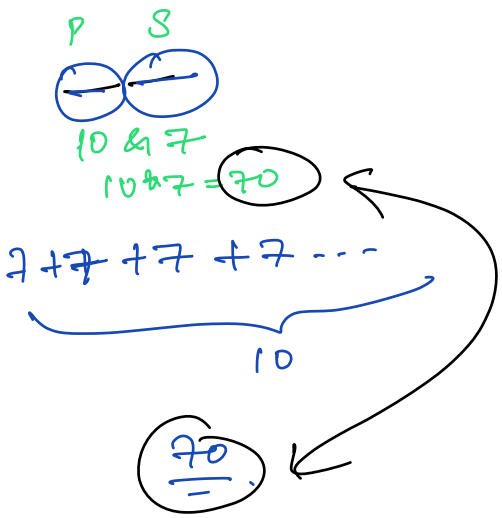
$2 + 2 + 2$

$2 * 2 * 2$ multiply

Ex1:- Given 10 plates and 7 spoons. How many different pairs are possible?

1 plate 1 Spoon.





Ex :-

ways to reach Hyderabad to Delhi via Mumbai?

1st view.

H1 → 4

H2 → 4

H3 → 4

12

2nd view.

Hyd → Mumbai → 3

AND → *

Mumbai → Delhi → 4

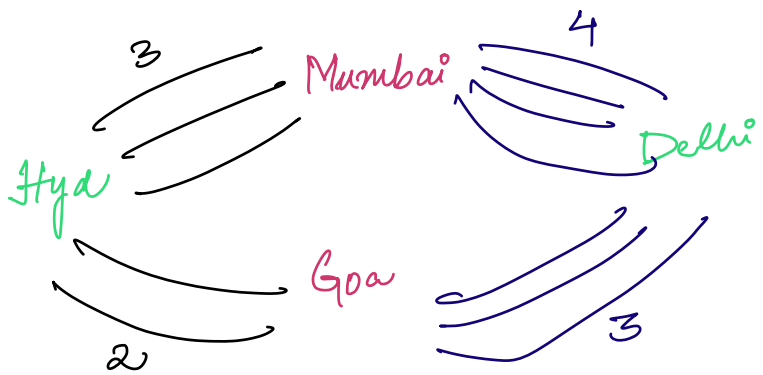
= 12

Ex:-

ways to reach Hyd to Delhi via Goa?

✓

Ex:



5 & 7

= 35.

ways to reach from Hyd to Delhi?

(Hyd → Mum. & Mumbai to Delhi — 3 & 4) OR (Hyd to Goa AND Goa to Delhi — 2 ↑ 3)

12 ~~OR~~ 6

Addition.

Ex Say we need to buy a gift.

(pen & book) or (flowers & chocolate) or (ring)

3 5 7 3 3

$3*5 + 7*3 + 3$

$15 + 21 + 3 \rightarrow 39$.

Permutations : Arrangement of objects

In general :- Order matters.

$(i,j) \; != \; (j,i)$

Q. Given 3 distinct characters. How many ways can you arrange them?

s = 'acd'

1st view.

acd
adc
cad
cda
dac
dca

6 arrangements.

2nd view.

3 * 2 * 1 → 6 → 3!.

a — c — d
a — d — c

c — a — d
c — d — a

d — a — c
d — c — a

Q. How many ways can you arrange 4 distinct characters? 'a b c d'

4 * 3 * 2 * 1 = 24. → 4!

_ _ _ _

a {b c d} {c d b} {d b c}

b {a c d}

c {a b d}

d {a b c}

Q How many ways to arrange n distinct elements?

N N-1 N-2 N-3 - - - - - - 1

N * (N-1) * (N-2) * (N-3) * - - - 1 = N! ✓

Q. Given 5 distinct characters, in how many ways can we arrange them in 2 places?

N = 5
R = 2 { a b c d e }

(1, 2) (2, 1)

Ayush Anshuman

$^5P_2 = \frac{5!}{(5-2)!} = \frac{5!}{3!} = \frac{5 \times 4 \times 3 \times 2 \times 1}{3 \times 2 \times 1} = 5 \times 4$

5 * 4 = 20.

a { b c d e }
b { a c d e }
c { a b d e }
d { a b c e }
e { a b c d }

a c
c a

a b
a c

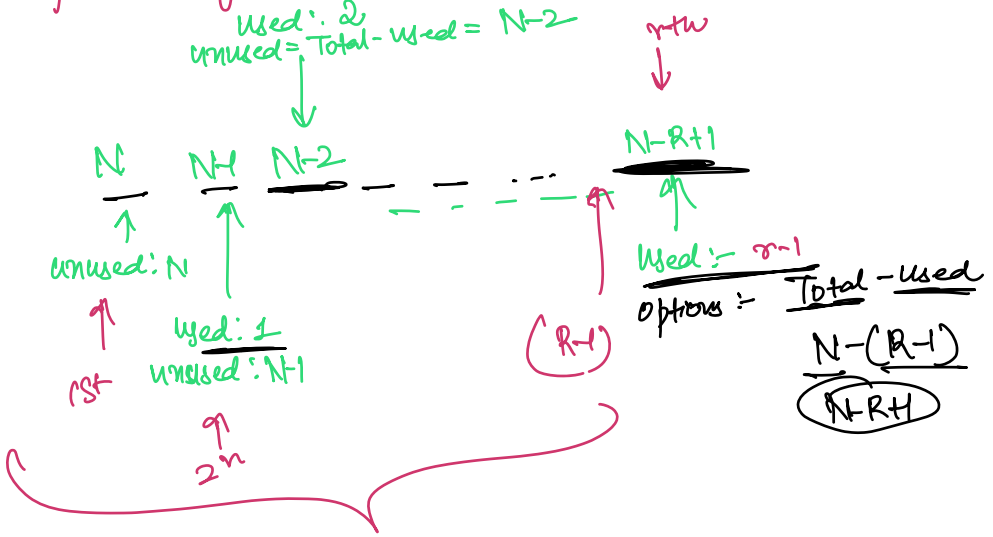
Q. N distinct characters, need to arrange 3 characters.

$(N)\ (N-1)\ (N-2) \rightarrow N * (N-1) * (N-2)$

Q. N distinct characters, need to arrange 4 characters

$(N) * (N-1) * (N-2) * (N-3)$

Q. N distinct characters, need to arrange r characters.
# of arrangements?



ways to arrange R items in R places =

$$\underbrace{(N)(N-1)(N-2)(N-3)\cdots(N-R+1)}_{R}$$

$$(N)(N-1)(N-2)\cdots(N-R+1) * \frac{(N-R)(N-R-1)(N-R-2)\cdots(1)}{(N-R)(N-R-1)(N-R-2)\cdots(1)}$$

$$\frac{N!}{(N-R)!} = {}^{N}P_{R}$$

Combinations (no. of ways to select)

Q. Given 4 cricketers, count ways of selecting 3 players.

P_1 P_2 P_3 P_4 } arrangement does not matter.

$P_1\ P_2\ P_3$

$P_1\ P_2\ P_4$

$P_1\ P_3\ P_4$

$P_2\ P_3\ P_4$

Q. number of ways to Arrange 4 players in 3 slots.?

$P_1\ P_2\ P_3$
$P_1\ P_3\ P_2$
$P_2\ P_1\ P_3$
$P_2\ P_3\ P_1$
$P_3\ P_1\ P_2$
$P_3\ P_2\ P_1$

$P_1\ P_2\ P_4$
$P_1\ P_4\ P_2$
$P_2\ P_1\ P_4$
$P_2\ P_4\ P_1$
$P_4\ P_1\ P_2$
$P_4\ P_2\ P_1$

$P_1\ P_3\ P_4$
$P_1\ P_4\ P_3$
$P_3\ P_1\ P_4$
$P_3\ P_4\ P_1$
$P_4\ P_1\ P_3$
$P_4\ P_3\ P_1$

$P_2\ P_3\ P_4$
$P_2\ P_4\ P_3$
$P_3\ P_2\ P_4$
$P_3\ P_4\ P_2$
$P_4\ P_2\ P_3$
$P_4\ P_3\ P_2$

$$N_{C_0} \qquad \frac{N!}{(N-0)!\,0!} = \frac{N!}{N!} = 1$$

Subsets.

$\{a\,b\,c\}$

Property 1

Property 2

ex:- 5 boys : $\{B_1, B_2, B_3, B_4, B_5\}$

B_1 B_2

B_1 B_3

B_1 B_4

B_1 B_5

B_2 B_3

B_2 B_4

B_2 B_5

B_3 B_4

B_3 B_5

B_4 B_5

Ques. Given N, R and P. Calculate $(^{N}C_{R})\ \%\ P$

Information: P is prime
N, R < P

constraints:
$1 <= (N,R) <= 10^5$
$R < N < P$