Random Process

⇒ where we know the possible outcomes but we have no idea about the result.

⇒ rolling a die of ludo

⇒ playing cards

⇒ head and tail of

⇒ elections

Sample space

All possible outcomes of a random process.

Example

$S = \{1,2,3,4,5,6\}$ rolling a die have 6 possible outcomes

$C = \{H, T\}$

$P = \{52 \text{ cards}\}$

Event An event is a subset of sample space

Equally Likely Events: When the possibility of all events is same.

Probability

When we roll a diee the possibitity that 6 will come is 1/6. So we can generalize

$$\frac{\text{No. of favourable outcome}}{\text{No. of total outcomes}} = \frac{N(E)}{N(S)} = 3/6 = 1/2$$

It is also called Naive because it assumes that all the events are equally like.
Suppose the possibility to live in Neptune is very less but it assumes that the possibility of live on neptune is same.

Event = {face card}

$N(E) = 6$

$N(S) = 52$

$$\frac{N(E)}{N(S)} = \frac{6}{52} = 6$$

Suppose we roll 2 die at once.
we want to know the possibility that the sum of two is 8.
First of all we have to know the sample space.
which is 36

$N(S) = 36$

$N(E) = \{2\,6, 4\,4, 6,2, 3,5, 5,3\}$

=

$$\frac{N(E)}{N(S)} = \frac{5}{36}$$

Finite ⇒ countable

Countably finite ⇒ one to one correspondence with natural numbers

⇒ ~~Hee~~ Hair of Sir Shehzad's head

⇒ leaves of tree

⇒ vote in any حلقہ

Infinite ⇒ In countable

$\boxed{\text{Counting Techniques:}}$

5,	6,	7	8	9	10	11	12
↓	↓	↓	↓	↓	↓	↓	↓
1	2	3	4	5	6	7	8

m	m	m	m	m	m	m	n
+	+	+	+	+	+	+	
	1	2	3	4	5	6	

$n = m + 7$ ⇒ $n - m + 1 =$

Suppose we want to know the ~~1~~ 2 digit natural numbers. So we write

$S = 99 - 10 + 1 = 90$

10 11 12 15 18 21 ..... 96 97 98 99

4 5 6 7 32 33

$\boxed{\text{Question}}$

what is the probability of getting a two digit integers divisible by 3

Sample space = 90

we can see that the first 2 digit number which is divisible by 3 is 12. $3 \times 4 = 12$.
And the last 2 digit number which is divisble by 3 is 99. $3 \times 33 = 99$

So

$m = 4$, Sample space $= 90 = N(S)$

$n = 33$.

$= n - m + 1$

$= 33 - 4 + 1$

$\boxed{N(E) = 30}$

So, ~~there are~~ probability is $\frac{N(E)}{N(S)}$

$= \frac{30}{90} = 1/3$

Question

What is the probability of getting a three digit integer divisible by 5.

$N(S)$ = Sample Spaces

100 105 110 115 .... 990 995 999

$\downarrow$ 20 $\downarrow$ 21 $\downarrow$ 22 $\downarrow$ 23 $\downarrow$ 198 $\downarrow$ 199

$N(S) = 900$

$999 - 100 + 1 = 900$

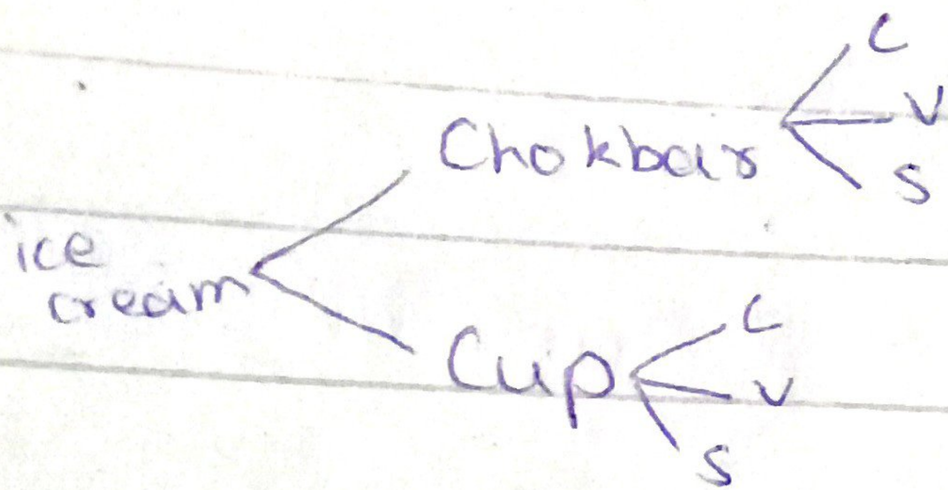
Now, we have to find the favourable out comes,

$199 - 20 + 1 = 180$

$$P(E) = \frac{\text{No. of favourable outcomes}}{\text{Total Outcomes}}$$

$$= \frac{N(E)}{N(S)} = \frac{180}{900} = 1/5$$

Possibility Tree

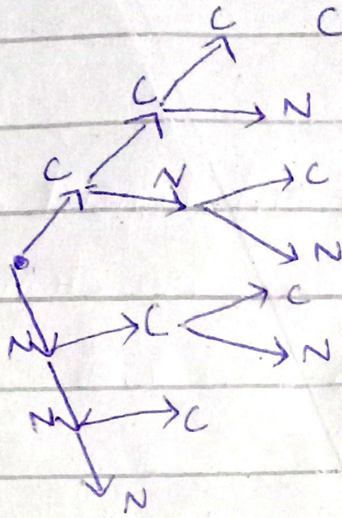


probability of getting vanilla icecream is

$2/6 = 1/3$

Example

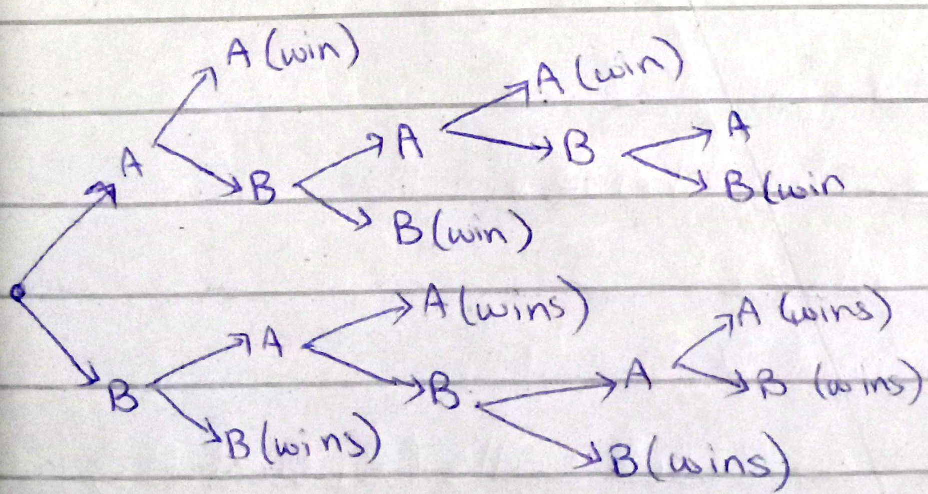
Three patient people want to meet covid patient. possibility of getting covid is 50:50



CCC
CCN
CNC
CNN
NCC
NCN
NNC
NNN

$$P(E) = \frac{N(E)}{N(S)} = 4/8 = 1/2$$

Counting And Probability



Total Possibilities :- Total wins (10)

Buy a Computer

Models of Cpu Box = 3
Models of keyboard = 2
Models of LED = 2

$\Rightarrow 3 \times 2 \times 2$

Multiplication Rule:

"If an experiment consist of 'k' steps. 1st step can be done in n_1 ways. 2nd step can be done in n_2 ways."

3rd	"	"	n_3	"
4th	"	"	n_4	"
k th	"	"	n_k	"

Then total outcomes of experiment are

$n_1 \times n_2 \times n_3 \times \ldots\ldots n_k$

$\boxed{\text{Example}}$

Suppose we have,

pots = 2

P_1 and P_2

P_1: has two Black balls (B_1 and B_2) and one white ball

P_2: two white Balls (w_1 and w_2) and one Black Ball (B)

Experiment:

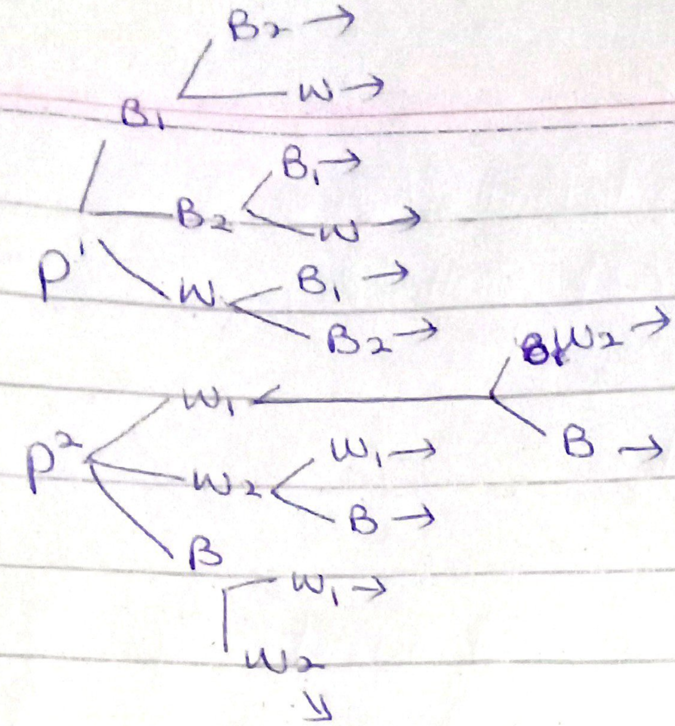
1) Choose a pot randomly $\rightarrow 2$
2) Choose a ball randomly $\rightarrow 3$
3) choose 2nd ball randomly $\rightarrow 2$
without replacement

Total numbers of outcomes of experiment $= 12$.

Possibility of two Black Balls Chosen?

$$P(E) = \frac{N(E)}{N(S)} = \frac{2}{12} = \frac{1}{6}$$

$$N(E) = 1 \times 2 \times 1 = 2$$



By using tree:-

probability of choosing balls of different color is

$P(E) = \frac{8}{12} = \frac{2}{3}$

Example

Suppose:

City A, B, C

Three roads from A to B = 3

Roads from B to C = 5

step1 = A to B = 3

step2 = B to C = 5

step3 = C to B = 4

step4 = B to A = 2

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

$S = \{A, B, C, D\}$

Permutation:

"A permutation of set of 'n' objects is an ordering of objects in a row"

n can be any integer

$\boxed{\text{Example}}$

C O M P U T E R

↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓

8 7 6 5 4 3 2 1

$n! = 8! =$

If we want to keep 'CO' in the same place we consider them a single element

$\underline{CO}$ M P U T E R

↓ ↓ ↓ ↓ ↓ ↓ ↓

7 6 5 4 3 2 1

$7!$

Kahani khatam hai!

(Horrible)