1. What is Probability?

→ Probability is a measure of likelihood that a particular event will occur.

Formula :- $P(E) = \frac{\text{No. of outcomes}}{\text{Total outcomes}}$

$P(E)$ = Probability of event E

Eg: Rolling a dice, what is prob of 4?

→ $P(4) = \frac{1}{6} = 0.1667$

2. Probability terminology :-

→ Experiment :- An activity with uncertain results, like rolling a die or drawing a card.

→ Outcome :- A single possible result of experiment

→ Sample space :- The collection of all possible outcomes

→ Event (E) :- A specific outcome or a group of outcomes we're interested

→ Probability :- A no. from 0 to 1 show how likely an event is.

→ Favourable :- The outcomes that satisfy the event we're looking for

3 Eg:

1] P(study hours < 4) = $\frac{3}{20}$

2] P(Pass) = $\frac{11}{20}$

3] P(group-discussion - yes) = $\frac{12}{20} = \frac{3}{5}$

4 Emprical probability :-

What is probability that a student passes in final exam

P(Pass) = $\frac{\text{No of pass in final exam}}{20} = \frac{11}{20}$

Theoratical probability :-

If each student is equally likely to study any no. of hours from 0 - 10. What is prob a random chosen stude studies at least 8 hours per week?

P(study-hours ≥ 8) = $\frac{3}{11}$

5 Random variable

A random variable is a numerical qnt whose valve depends on outcome of a random phenomenon or experiment

→ Let X = No. of students pass in exam

$X \in \{0, 1, 2, 3\}$

Table:

x	P(x)	x × P(x)
0	0.027	0
1	0.189	0.189
2	0.441	0.882
3	0.343	1.029

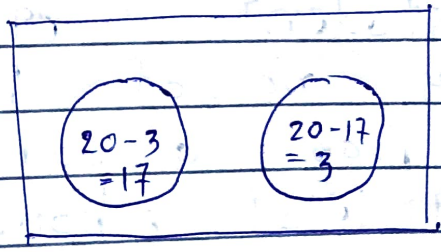
Mean = $\Sigma(x_i \times P(x_i)) = 0 + 0.189 + 0.882 + 1.029 = 2.1$

Variance = $\Sigma[x_i^2 \cdot P(x_i)] - \mu^2 = 3 \times 0.7 \times 0.3 = 0.63$

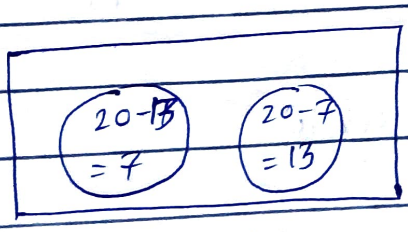
6 Venn diagram:

→ Students who study more than 10 hrs

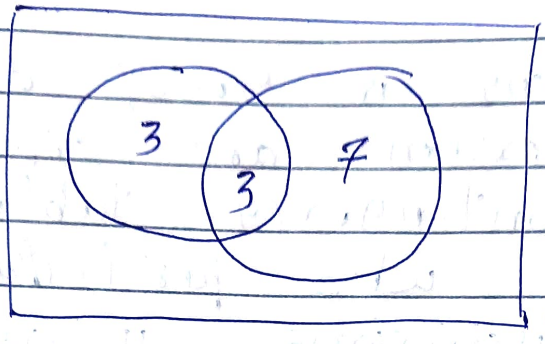
→



→ Students has 80% attendance



→ Overlap:



7 Contingency table:

	Yes	No	Total
Pass	11	3	14
fail	1	5	6
Total	14	8	20

→ Joint probability :- $\frac{P(\text{Yes} \cap \text{Pass})}{\text{total student}} = \boxed{\frac{11}{20}}$

→ Marginal Probability :- $\frac{P(\text{Pass})}{\text{total student}} = \frac{14}{20} = \boxed{\frac{7}{10}}$

→ Conditional : $P(\text{Yes} \cap \text{Pass} \mid \text{Pass}) = \frac{11}{20} \times \frac{10}{7} = \frac{110}{140}$

$= \boxed{\frac{11}{14}}$

8 Understanding relationships

→ Participating in group discussion and passing exam are dependent events.

→ From contingency table, among students who participated in group discussions, 11 out of 12 are passed, so

$$P(\text{Pass} \mid \text{Yes}) = \frac{11}{12} = 0.92$$

→ Among students who did not participated, only 3 out of 8 passed

So

$$P(\text{Pass} \mid \text{No}) = 3/8 = 0.375$$

9 Bayes theorem:

$$P(A \mid B) = \frac{P(B \mid A) \times P(A)}{P(B)}$$

A

A = Student passed exam

B = Student has high attendance (80%)

→ $P(A) = \frac{14}{20} = \frac{7}{10}$

→ $P(B) = \frac{7}{20}$

$$\Rightarrow P(B|A) = \frac{P(B \cap A)}{P(A)} = \frac{\frac{7}{20}}{\frac{7}{10}} = \frac{\cancel{7}}{20} \times \frac{10}{\cancel{7}} = \frac{1}{2}$$

$$\rightarrow P(B|A) = 1/2$$

$$\Rightarrow \quad P(A|B) = \frac{P(B|A) \times P(A)}{P(B)}$$

$$= \frac{1/\cancel{2} \times \cancel{7}/10}{\frac{\cancel{7}}{\cancel{2}0}} = \boxed{1}$$