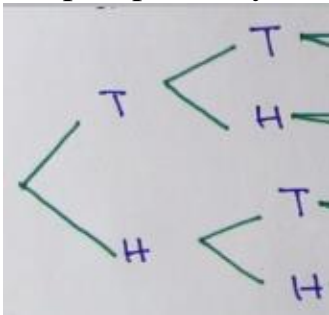


Outline:

- 1) Sample space
- 2) Probability value
- 3) Event
- 4) Complement of events
- 5) Intersections of events
- 6) Mutually exclusive events
- 7) Unions of events

1) Sample space: The sample space (S) of an experiment is a set consisting of all of the possible experimental outcomes.

- Example : A usual six-sides dice has a sample space $S = \{1,2,3,4,5,6\}$
- If you toss a coin, the sample space $S = \{H,T\}$.
- What is the sample space when a coin is tossed two times? Or What is the sample space, if you toss two coins?



Ie if I toss a coin two times, the possible outcomes are HH, HT, TH, TT
So $S = \{ HH, HT, TH, TT \}$.

- **Class work:** 1) By using tree diagram write down the sample space when a coin is tossed three times?
- 2) What is the sample space for choosing a prime number less than 15 at random?
(Note: A prime number is number greater than one that is only divisible by one and itself.)

3) What is the sample space for counting the number of females in a group of n people?

4) What is the sample space for the number of aces in a hand of 13 playing cards?

5) What is the sample space for a person's birthday?

6) A car repair is performed either on time or late and either satisfactorily or unsatisfactorily. What is the sample space for a car repair?

- If you throw two dice,

	1	2	3	4	5	6
1	(1,1)	(1, 2)	(1,3)	(1,4)	(1,5)	(1,6)
2	(2,1)	(2, 2)	(2,3)	(2,4)	(2,5)	(2,6)
3	(3,1)	(3, 2)	(3,3)	(3,4)	(3,5)	(3,6)
4	(4,1)	(4, 2)	(4,3)	(4,4)	(4,5)	(4,6)
5	(5,1)	(5, 2)	(5,3)	(5,4)	(5,5)	(5,6)
6	(6,1)	(6, 2)	(6,3)	(6,4)	(6,5)	(6,6)

$$S = \{(1,1), (1,2), \dots\dots\dots(6,6)\}$$

2) Probability Values: Each outcome in the sample space has a probability value.

- Probability value = the number of favourable outcomes / the total number of possible outcomes.
- For example, if you toss a coin. Possible outcomes are {H,T}. $P(H) = (1/2)$
 $P(T) = 1/2$.
- Note: If all the outcomes of a sample space have the same chance of occurrence then probability value = $1 /$ the total number of possible outcomes.

Example: A fair dice have six (n) outcomes and each of the six outcomes must have a probability of $1/6$, i.e $P(1) = P(2) = P(3) = P(4) = P(5) = P(6) = 1/6$.

On a fair dice, every number has an equal chance of being rolled. On a biased dice, some numbers are more likely to be rolled than others. If a red

dice and a blue dice are thrown, with each of the 36 outcomes. let B be the event that at least one 6 is obtained on the two dice with a probability of $P(B) = 11/36$.

- **Classwork: 1) If a card is chosen at random from a pack of cards, what is the probability that the card is from one of the two black suits?**

Properties of Probability Values: 1) $0 \leq p \leq 1$;
2) $\sum P = 1$.

- **Classwork: 1) An experiment has five outcomes, I, II, III, IV, and V. If $P(I) = 0.13$, $P(II) = 0.24$, $P(III) = 0.07$, and $P(IV) = 0.38$, what is $P(V)$?**

2) An experiment has five outcomes, I, II, III, IV, and V. If $P(I) = 0.08$, $P(II) = 0.20$, and $P(III) = 0.33$, what are the possible values for the probability of outcome V? If outcomes IV and V are equally likely, what are their probability values?

3) Events: An event is a subset of the sample space.

Ex: $S = \{1,3,4\}$ and $A = \{4,1\}$, since A is a subset of the sample space S. So A is an event.

4) Complements of Events: The complement of an event A, is the event consisting of everything in the sample space S that is not contained within the event A.

Ex: A usual six-sided dice has a sample space $S = \{1,2,3,4,5,6\}$, If Event $A = \{1,3,6\}$ then complementary of event A = $\{2, 4, 5\}$.

5) Intersections of Events: contains common outcomes between two events.

Ex: $A = \{1,3,4\}$, $B = \{4\}$.

$A \cap B = \{4\}$

6) **Mutually Exclusive Events:** Two events A and B are said to be mutually exclusive if they have no outcomes in common.

Ex: $A = \{1,3,4\}$, $B = \{5\}$.

Since event A and B don't have any common outcome, so they are Mutually Exclusive Events.

Classwork: A card is chosen from a pack of cards. Are the events that a card from one of the two red suits is chosen and that a card from one of the two black suits is chosen mutually exclusive? What about the events that an ace is chosen and that a heart is chosen?

7) **Unions of Events:** Consists of the outcomes that are contained within at least one of the events A and B.

Ex: $A = \{1,3,4\}$, $B = \{5\}$.

$A \cup B = \{1,3,4,5\}$.