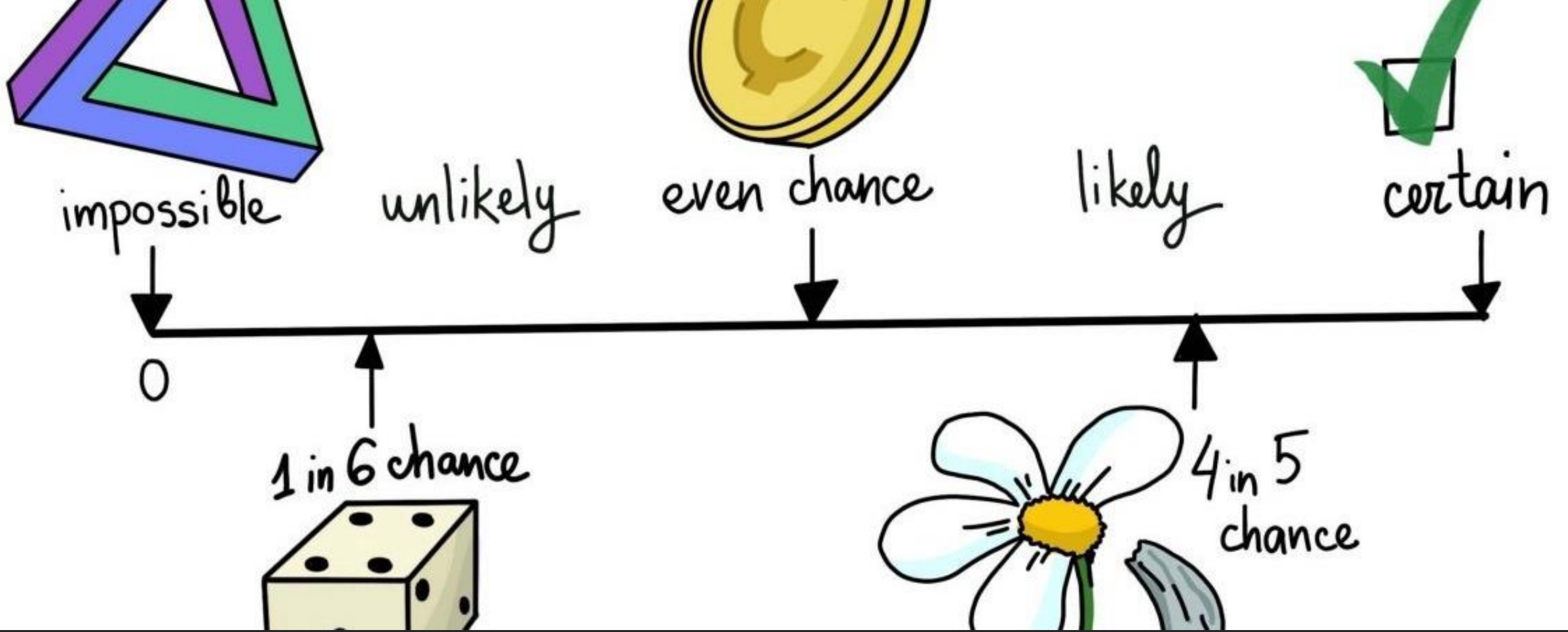




Probability

FOUNDATIONAL
MATHEMATICS I
(MA0014)



Probability

Terminology

Random Experiment

- A process which is conducted repeatedly under homogenous (identical) environment in which results may be different.

Trial

- Any performance of a random experiment is called a trial.

Experiment	Trial
picking 3 balls from a bag containing 10 balls (4R & 6 B).	Picking each ball. Thus, the experiment has 3 trials.
Tossing three coins	Tossing each coin. This too has 3 trials
Use of NPK on paddy	Use of NPK at Peradeniya. Many locations are trials
Number of goals in soccer matches during 2018	3 goals, 4 goals etc.

Terminology

Event

Outcome of a trial is known as an event.

Trial	Event
Two or more heads in throwing 3 coins	{HHH, HTH, THH, HHT}
Sum less than 5 in throwing 2 dice	{(1,1), (1,2), (1,3), (2,1), (2,2), (3,1)}

Terminology

Sample Space

The set of all possible outcomes of a given experiment is known as sample space.

Eg. In a trail of throwing a die – {1,2,3, 4, 5, 6}

In rolling a pair of dice $S = \{36 \text{ points}\}$

$= \{(1,1), \dots, (1,6), \dots, (6,5), (6,6)\}$

There are 2 types of sample spaces.

- **Finite Sample Space**

Sample space that contains a finite number of outcomes

- **Continuous Sample space**

Sample space that contains an interval of values
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Sample Point

A particular outcome of the experiment is known as sample point.

Events

Simple Event

An event that can be described by a single characteristic.

Eg. In rolling a die the chance of getting an even number is a simple event.

Compound (Joint) Event

An outcome from a sample space with two or more characteristic simultaneously is called a joint event. Eg. Drawing a red ace from a deck of cards.

Events

Mutually Exclusive Event (Disjoint event)

Events cannot happen at the same time.

Eg: If we toss a coin, either heads or tails might turn up,

In a single throw of a die, we can only have one number shown at the top face.

$$A \cap B = \emptyset$$

Equally Likely Events

Two or more events are said to be equally likely if the chance of their happening is the same.

Eg: Obtaining 1 or 2 or 3 by throwing an unbiased die

Events

Independent Events

Happening of one event does not influence the other event.

Eg: Choosing a marble from a jar AND landing on heads after tossing a coin

Attending to Maths class and playing a tennis game

Collectively exhaustive events

One of the events must occur. The set of events covers the entire sample space.

Events

The null subset (\emptyset) of S is called an impossible event.

The event $A \cup B$ consists of all outcomes that are in A or in B or in both.

The event $A \cap B$ consists of outcomes that are both in A and B .

The event A^c (the complement of A in S) consists of all outcomes not in A , but in S .



Rolling a 14



Heads



The sun will rise



Probability

Probability

is a concept which numerically measures the degree of uncertainty of an event.

In real world most events are uncertain.

Thus, probability is a statistical quantity (measure) of how likely an event occurs.

It is the likelihood or chance that a particular event will occur.

Eg. Probability of

Covid 19 curve will be flattening during April, 2021

winning a game by the Sri Lankan team

price of rice going up

Probability

The notation for the statement “Probability of the event A” is denoted as $\Pr(A)$ or $P(A)$.

The value for the probability is between 0 and 1.

A probability of 1 means that we are 100% sure of the occurrence of an event.

A probability of 0 means that we are 100% sure of the non-occurrence of an event.

The probability of S is always 1 ($\Pr(S) = 1$).

The probability of an impossible event is always 0. ($\Pr(\emptyset) = 0$).



Probability

Classical Definition of Probability

If there are N equally likely outcomes, of which one must occur, and n of these are regarded as favourable to an event, then the probability of the event is given by $\frac{n}{N}$.

Frequency (Empirical) Definition of Probability

The probability of an event is the proportion of times the event would occur in a long run of repeated experiments.

Probability of the Event = $\frac{\text{Number of favourable outcomes observed}}{\text{Total number of outcomes observed}}$

Subjective Probability

An individual judgement or opinion about the probability of occurrence.

Probability

$P(A) \geq 0$, for any event A.

$$P(S) = 1$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

If 2 events A and B are independent, $P(A \cap B) = P(A) * P(B)$

If 2 events A and B are disjoint, $P(A \cup B) = P(A) + P(B)$

What is Probability?

Exercise

What is the probability of getting sum of 9 with two dice?

What is the probability of getting 2 heads when you toss two coins?



Conditional Probability

$P(A|B)$ – Probability of event A given that B has already occurred

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

Independence

An event B is said to be an independent event of an event A if

$$p(B) = p(B/A)$$

If A and B are independent events then,

$$P(A \cap B) = P(A) * P(B)$$



Exercise

1. Of the cars on a used car lot, 70% have air conditioning and 40% have a CD player. 20% of the cars have both. What is the probability that a car has a CD player, given that it has AC ?
2. If two balanced dice are tossed, find the probability that the sum of the face values is 8, if the face value of the first one is 3.

Conditional Probability

Thank You

QUESTIONS?