

Introduction to Random Variables



Outline

① Random Events in Daily Life

② Random Variables

Learning Objectives

By the end of this video, we hope that you will be able to:

- Understand random variables.
- Differentiate the two types of random variables.
- Understand that we need a method of describing or defining a random variable completely.

Random Events in Daily Life

Randomness

Random events in daily life:

- Whether it will rain tomorrow,
- Whether coin tossed is head or tail,
- Whether stock market will plummet or surge the next day

Random events

Random events are those that are not deterministic; if we could repeat the event, there is no guarantee that we will observe the same outcome.



NUS Shuttle Bus

- Some of the reasons why you use an NUS shuttle bus: Travelling from MRT station to your department, or just to go for lunch.
- NUSNextBUS app tells us that the bus is arriving in the next minute.



- The exact second at which the bus arrives and opens its doors is unknown until it happens.

Factors

Traffic congestion, bad weather, road works, or some other reason that we could not foresee.

Bus Stop Video

Random Variables

Random Variables

- Random variables represent the outcome of **random events** using **numbers**.

Random events

- ▶ Number of people waiting at the bus stop
- ▶ Whether there is any seat available for every NUS Shuttle bus arriving at the station observed
- E.g. if denote X as the number of people waiting at the bus stop, then $X = 2$ denotes the event that there were 2 people waiting at the bus stop.



Random Variables

- Random variables represent the outcome of **random events to numbers**.

Random events

- ▶ Number of people waiting at the bus stop
- ▶ Whether there is any seat available for every NUS Shuttle bus arriving at the station observed
- E.g. If X denotes the number of people waiting at the bus stop, then $X = 2$ is the event that there were 2 people waiting at the bus stop.
- E.g. If Y denotes as to whether there is any seat available on the bus, then $Y = 0$ is the event that there were no seats available on the bus.



Properties of Random Variables

Some properties of random variables:

- The number of people waiting at the bus stop would be an integer.
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- The time between bus arrivals would be a continuous number.

Summary table:

Types of Random Variables	Examples	Notations
Discrete	Number of people waiting at the bus stop	$X = 0, 1, 2, 3, \dots$
Continuous	Time between bus arrivals The change in temperature in the bus stop	$X = 5.7, 5.8, \dots$ $Y = -0.3, -0.1, 0.1, \dots$

Why Random Variables?

Why understand random variable?

- We need a full characterisation, that tells us the individual probabilities of all possible outcomes.
- If X is the number of people at the bus stop for the NUS shuttle bus, we need a way of communicating the probability that $X = 4$, $X = 5$, and so on.
- If Y is the number of people waiting for an SBS bus service, for instance, these probabilities would be different.
- This denumeration of probabilities of all possible outcomes of a random variable is done with a probability distribution.
- If we know the probability distribution of two random variables, we can compare them. We can use distribution to make decisions concerning the random variables.

Random Events in NUS

Can you think of any random events happening around NUS?

- Scenario: When we go for lunch at noon, the length of the queue at the noodles stall is usually between 5 and 12 people, but we do not know beforehand what that exact length will be.
- If X denotes the number of people queuing at the noodles stall, then $X = 6$ is the event that there were 6 people queuing at the noodles stall.

Task

Think about some of the random events you encounter in your daily life.



Summary

Learning Outcome

- Understand what are random variables.
- Able to differentiate the two types of random variables.
- Understand that we need a method of describing or defining a random variable completely.

Things to remember:

- We will be using capital letters (e.g. X and Y) to represent random variables.
- When using random variables, actual events in the real world will be coded as numbers.

