

Recorded lectures

All the lecture videos are accessible at:

<https://drive.google.com/drive/folders/1wmuvwRFF1SXA0E5b6l8Nudi2zsPGLT9i?usp=sharing>

Module 4: Random variable and hypothesis testing.

Lecture 11: Random variable and cumulative distribution function

The purpose of this lecture is to review several key concepts in probability. If you are certain that you have mastered the following concepts, you are welcome to skip this lecture.

- Reading materials:
 - [Pishro-Nik book](#) chapter 3.1 – 3.1.4.
 - [Pishro-Nik book](#) chapter 3.2.1.
 - [Pishro-Nik book](#)'s accompanying videos:
 - [Video 3.1 – Introduction to Random Variables: Discrete Random Variables - Part 1](#)
 - [Video 3.2 - Discrete Random Variables, PMF, Independent Random Variables](#)
 - [Video 3.5 – CDF for Discrete Random Variables](#)
- Pre-recorded lecture video
- Core concepts:
 - Random variable (RV)
 - Discrete random variable
 - Probability mass function (PMF)
 - Cumulative distribution function (CDF)
- Not required contents: book chapters other than 3.1 – 3.1.4 and 3.2.1.

Section 1

Chapter 3.1.1. Random variables.

1. Definition.
2. Example 3.1.
3. Example 3.2.

Section 2

Chapter 3.1.3. Probability mass function

1. Definition
2. Example 3.3
3. Plotting a PMF: Figure 3.1

Section 3

4. Example 3.4

Section 4

Chapter 3.2.1. Cumulative distribution function

1. Definition 3.10

Lecture 12. Hypothesis testing

- Reading materials:
 - [Pishro-Nik book](#) chapter 8.4.1-8.4.2, chapter 8.4.4.
 - Course handout, Chapter 6.1
 - Lecture 12's slides
- Pre-recorded lecture video
- Core concepts:
 - Null and alternative hypotheses
 - Test statistic
 - P-value
- **Not required** contents: Pishro-Nik chapters 8.1 – 8.3.

Section 1

An overview of the major steps of hypothesis testing.

Section 2

Forming two competing hypotheses, called **the null (H₀)** and **the alternative hypothesis (H₁)**.

Section 3

Generating or getting data.

Section 4

Summarizing the data into a **Test Statistic**.

Section 5

Calculating the **p-value**.

Section 6

Making a decision based on p-value.

Lecture 13. Acceptance and rejection regions

- Reading materials:
 - [Pishro-Nik book](#) chapters 8.4.2 and 8.4.4.
 - Course handout, Chapter 6.1
- Core concept:
 - Acceptance region and rejection region
 - Type I error
 - Significance level
 - Type II error
- **Not required** contents: Pishro-Nik chapter 8.4.5.

(Optional) Section 1

Review of the major steps for hypothesis testing.

Section 2

An alternative way of making a decision:

- Acceptance region

Section 3

- Type I error
- Type II error
- Significance level

Lecture 16. An introduction to liquid biopsy and cancer classification by extracellular RNA