



First Exam, First Semester: 2019/2020
Dept. of Communication & Electronics Engineering

Course Title:	Probability and Random Variables	Date:	25/11/2019
Course No:	650364	Time Allowed:	60 minutes
Lecturer:	Dr. Qadri Hamarsheh	No. Of Pages:	5

Instructions:

- **ALLOWED:** pens, calculators and drawing tools (**no red color**).
- **NOT ALLOWED:** Papers, literatures and any handouts. Otherwise, it will lead to the non-approval of your examination.
- **Shut down** Telephones, and other communication devices.

Please note:

- This exam paper contains 4 questions totaling 20 marks.

Basic notions: The aims of the questions in this part are to evaluate the required minimal student knowledge and skills. Answers in the pass category represent the minimum understanding of basic concepts: Set definitions and operations, Joint and conditional Probability, Bayes' Theorem, Independent events, Random variable concept, Discrete and continuous random variables, Density function, Distribution functions, Gaussian random variable and Other density functions

Question 1 Multiple Choice

(6 marks)

Identify the choice that best completes the statement or answers the question.

- 1) The type of probability that uses **sample spaces** is called

a) Classical probability	b) Subjective probability
c) Empirical probability	d) Relative probability

- 2) When a **coin** is tossed and then a **die** is rolled, the probability of getting a **tail** on the coin and an **odd** number on the die is

a) 1/2	b) 1/4
c) 3/4	d) 1/6

- 3) $P(A \cap B) = P(A) \cdot P(B)$, then **A** and **B** are

a) Mutually Exclusive Events	b) Independent Events
c) Dependent Events	d) Equally Likely Events

- 4) At a high school with **300** students, **62** play football, **33** play baseball, and **14** play both sports. If a student is selected at random, find the probability that the student plays football or baseball.

a) 109/300	b) 14/300
c) 19/60	d) 27/100

- 5) In binomial distribution **n=6** and **p=0.9**, then the value of **P(X=7)** is

a) Zero	b) More than zero
c) Less than zero	d) One

- 6) For a probability density function (**PDF**), the probability of a **single point** is

a) Constant	b) 0
c) 1	d) 2

Familiar and Unfamiliar Problems Solving: The aim of the questions in this part is to evaluate that the student has some basic knowledge of the key aspects of the lecture material and can attempt to solve familiar and unfamiliar problems: Set definitions and operations, Joint and conditional Probability, Bayes' Theorem, Independent events, Random variable concept, Discrete and continuous random variables, Density function, Distribution functions, Gaussian random variable and Other density functions

Question 2

(7 marks)

a) Draw a **tree diagram** and find the **sample space** for the genders of the children in a family consisting of **3 children**. Find the probability of (2 marks)

- **Three girls.**
- **Two boys and a girl in any order.**

Solution

b) **Coin** tossed **eight** times; find the probability of getting **exactly 3 heads**. (1.5 marks)

Solution

c) Let **A**, **B**, and **C** be three events in the sample space **S**. Suppose we know

(1.5 marks)

- $A \cup B \cup C = S$
- $P(A) = \frac{1}{2}$
- $P(B) = \frac{2}{3}$
- $P(A \cup B) = \frac{5}{6}$

Find $P(A \cap B)$

Solution

d) We roll a **fair die**. Let **A** be the event that the outcome is an **odd number**. Also let **B** be the event that the outcome is **less than or equal to 3**.

(2 marks)

- What is the probability of **A**?
- What is the probability of $P(\mathbf{A} | \mathbf{B})$?

Solution

Question 3

(4 marks)
(2 marks)

a) Let X be a discrete random variable with the following **PMF**

$$P_X(x) = \begin{cases} 0.3 & \text{for } x = 3 \\ 0.2 & \text{for } x = 5 \\ 0.3 & \text{for } x = 8 \\ 0.2 & \text{for } x = 10 \\ 0 & \text{otherwise} \end{cases}$$

Find and plot the **CDF** of X .

Solution

b) Let X be a random variable with **PDF** given by

(2 marks)

$$f_X(x) = \begin{cases} cx^2 & |x| \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

Find the constant c .

Solution

Question 4

(3 marks)

Suppose we know that **75%** of the **female** engineering students and **15%** of **male** engineering students have **long hair**. We also know that approximately **27%** of all engineering students are **girls**.

- a) What is the probability that a random student is long-haired?**
- b) What is the probability that a random long-haired engineering student is female**

Solution

GOOD LUCK