



Habib University

Course Code: EE 354/CE 361

Course Title: Intro to Probability & Statistics

Instructor's name: Dr. M. Shahid Shaikh

Examination: Assignment #1

Given: 7 September 2023

Total Marks: 40

Due: 16 September 2023

Problem 1. [4 Points]

A four-sided die is rolled repeatedly, until the first time (if ever) that an even number is obtained.

- (a) What is the sample space for this experiment? Justify your answer. [1]
- (b) Assuming that the die is fair, what is the probability that it lands on a 1 or a 4 on the first roll? Justify your answer. [3]

Problem 2. [11 Points]

Let A and B be two sets.

- (a) Using set properties, show that:

$$\begin{aligned}A^C &= (B \cap A^C) \cup (B^C \cap A^C), \\ B^C &= (B^C \cap A) \cup (B^C \cap A^C).\end{aligned}$$

Mention the set properties where appropriate.

- (b) Using set properties, show that:

$$(A \cap B)^C = (A^C \cap B^C) \cup (A^C \cap B) \cup (A \cap B^C)$$

Mention the set properties where appropriate.

Problem 3. [7 Points]

Consider rolling a six-sided die. Let A be the set of outcomes where the roll is an odd number. Let B be the set of outcomes where the roll is less than 4. Using set notation, calculate the sets on both sides of the equality in part (b) of Problem 2, and verify that the equality holds.

Problem 4. [18 Points]

You're an analyst working in a Casino. One of your jobs includes testing dice confiscated from unwelcome cheaters. One day you receive a box of dice with a note on it:

"Each even face is twice as likely as each odd face. All even faces are equally likely, as are all odd faces. Please check if it's more likely to roll more than 3 or not. Thanks in advance!"

You pick out a die and start rolling it.

- (a) What *Experiment* is being conducted in the problem above? [1]
- (b) What should be the *Sample Space* for the problem above? Give your answer in set notation. [1]
- (c) What *Event(s)* does the colleague mention in their note? Give your answer in set notation. [2]
- (d) Which of the *Event(s)* you identified in (c), are *Disjoint*? Give your reasoning in set notation? Draw a Venn diagram to represent your model visually, making sure to label it completely. [2]
- (e) For which of the *Event(s)* you identified in (c), does the Finite Additivity Axiom of probability hold true? [1]
- (f) Find the probability that the die lands on an even face and an odd face. [4]
- (g) Is this die more likely to roll more than 3 or not? Using set notation, justify what you tell your colleague? [7]