

Instructor: Dr. Ozan Eruygur
Research Assistant: Damla Hacıbrahimoğlu

PROBLEM SET 02

PROBLEM 1

Draw Venn diagrams to verify DeMorgan's Laws. That is, for any two sets A and B,
 $\overline{A \cup B} = \overline{A} \cap \overline{B}$ and $\overline{A \cap B} = \overline{A} \cup \overline{B}$.

PROBLEM 2

Suppose two dice are tossed and the numbers on the upper faces are observed. Let S denote the set of all possible pairs that can be observed. [These pairs can be listed, for example, by letting (2, 3) denote that a 2 was observed on the first die and a 3 on the second.] Define the following subsets of S :

A: The number on the second die is even.

B: The sum of two numbers is even.

C: At least one number in the pair is odd.

List the points in $A, \overline{C}, A \cap B, A \cap \overline{B}, \overline{A} \cup B,$ and $\overline{A} \cap C$.

PROBLEM 3

From a survey of 60 students attending a university, it was found that 9 were living off campus, 39 were undergraduates, and 3 were undergraduates living off campus.

- Find the number of these students who were undergraduates, were living off campus, or both.
- Find the number of these students who were undergraduates living on campus.
- Find the number of these students who were graduate students living on campus.

PROBLEM 4

A sample space consists of five simple events, E_1, E_2, E_3, E_4 and E_5 .

- a) If $P(E_1) = P(E_2) = 0.15$, $P(E_3) = 0.4$ and $P(E_4) = 2P(E_5)$, find the probabilities of E_4 and E_5 .
- b) If $P(E_1) = 3P(E_2) = 0.3$, find the probabilities of the remaining simple events if you know that the remaining events are equally probable.

PROBLEM 5

A vehicle arriving at an intersection can turn right, turn left or continue straight ahead. The experiment consists of observing the movement of a single vehicle through the intersection.

- a) List the sample space for this experiment.
- b) Assuming that all sample points are equally likely, find the probability that the vehicle turns.

PROBLEM 6

Suppose two balanced coins are tossed and the upper faces are observed.

- a) List the sample points for this experiment.
- b) Assign a reasonable probability to each sample point. (Are the sample points equally likely?)
- c) Let A denote the event that *exactly* one head is observed and B the event that *at least* one head is observed. List the sample points in both A and B .
- d) From your answer to (c) find $P(A)$, $P(B)$, $P(A \cap B)$, $P(A \cup B)$ and $P(\overline{A \cup B})$.

PROBLEM 7

Four equally qualified people apply for two identical positions in a company. One and only one applicant is a member of a minority group. The positions are filled by choosing two of the applicants at random.

- a) List the possible outcomes for this experiment.
- b) Assign reasonable probabilities to the sample points.
- c) Find the probability that the applicant from the minority group is selected for a position.

PROBLEM 8

Two additional jurors are needed to complete a jury for a criminal trial. There are six prospective jurors, two women and four men. Two jurors are randomly selected from the six available.

- a) Define the experiment and describe one sample point. Assume that you need describe only the two jurors chosen and not the order in which they were selected.
- b) List the sample space associated with this experiment.
- c) What is the probability that both of the jurors selected are women?

PROBLEM 9

A boxcar contains six complex electronic systems. Two of the six are to be randomly selected for thorough testing and then classified as defective or not defective.

- a) If two of the six systems are actually defective, find the probability that at least one of the two systems tested will be defective. Find the probability that both are defective.
- b) If four of the six systems are actually defective, find the probabilities indicated in (a).

PROBLEM 10

A retailer sells only two styles of stereo consoles, and experience shows that these are in equal demand. Four customers in succession come into the store to order stereos. The retailer is interested in their preferences.

- a) List the possibilities for preference arrangements among the four customers (that is, list the sample space).
- b) Assign probabilities to the sample points.
- c) Let A denote the event that all four customers prefer the same style. Find $P(A)$.