**Lab 12 Counting**

**Objective**

Solving exercises from the textbook.

**Current Lab Learning Outcomes (LLO)**

By completion of the lab, the students should be able to

1. Understand basics of counting and pigeon hole principle

2. Solve shorter/easier or longer / harder problems given in the textbook.

**Lab Requirements**

Students allowed using their lecture notes in the lab and use blackboard slides in order to solve the exercises.

**Lab Assessment**

1- Divide students to groups and let them to solve the given example.

2- Discuss the answers with the groups and write on board the optimal solution.

**Lab Description**

In this lab, students learn how to apply the basic counting principles, the pigeonhole principle, and permutations and combinations to solve counting problems

1. A club has 25 members.
2. How many ways are there to choose four members of the club to serve on an executive committee?
3. How many ways are there to choose a president, vice president, secretary, and treasurer of the club, where no person can hold more than one office?
4. Suppose that a department contains 10 men and 15 women. How many ways are there to form a committee with six members if it must have the same number of men and women?
5. There are 38 different time periods during which classes at a university can be scheduled. If there are 677 different classes, how many different rooms will be needed?
6. Suppose that every student in a discrete mathematics class of 25 students is a freshman, a sophomore, or a junior.

Show that there are at least nine freshmen, at least nine sophomores, or at least nine juniors in the class.

1. What is the minimum number of students, each of whom comes from one of the 50 states, who must be enrolled in a university to guarantee that there are at least 100 who come from the same state?
2. How many bit strings of length 10 contain

**a)** exactly four 1s?

**b)** at most four 1s?

**c)** at least four 1s?

**d)** an equal number of 0s and 1s?

1. A coin is flipped 10 times where each flip comes up either heads or tails. How many possible outcomes

**a)** Are there in total?

**b)** Contain exactly two heads?

**c)** Contain at most three tails?

**d)** Contain the same number of heads and tails?

1. How many permutations of the letters *ABCDEFG* contain

**a)** the string *BCD*?

**b)** the string *CFGA*?

**c)** the strings *BA* and *GF*?

**d)** the strings *ABC* and *DE*?

**e)** the strings *ABC* and *CDE*?

**f )** the strings *CBA* and *BED*?

1. Find the value of each of these quantities.
   1. *P(*6*,* 3*)* b. *P(*8*,* 8*) c. C(*5*,* 3*) d. C(*8*,* 8*)*

A drawer contains a dozen brown socks and a dozen black socks, all unmatched. A man takes socks out at random in the dark.

**a)** How many socks must he take out to be sure that he has at least two socks of the same color?

**b)** How many socks must he take out to be sure that he has at least two black socks?

1. Find the number of 5-permutations of a set with nine elements
2. In how many different orders can five runners finish a race if no ties are allowed?
3. Seven women and nine men are on the faculty in the mathematics department at a school.

**a)** How many ways are there to select a committee of five members of the department if at least one woman must be on the committee?

**b)** How many ways are there to select a committee of five members of the department if at least one woman and at least one man must be on the committee?

1. One hundred tickets, numbered 1*,* 2*,* 3*, . . . ,* 100, are sold to 100 different people for a drawing. Four different prize are awarded, including a grand prize (a trip toTahiti).How many ways are there to award the prizes if the person holding ticket 47 wins one of the prizes?