



Name : _____
Student ID : _____ Section : _____
Date : _____

**ASSIGNMENT 2 – Recurrence Relation, Counting Methods,
Permutations and Combinations, Pigeonhole Principle**

Group of 3, Due date: 25 November 2024

Recurrence Relation

1. Write the first five terms of the sequence defined by the recurrence relation $a_n = 3a_{n-1} + 2$ with the initial condition $a_0 = 1$.
2. Given the sequence $b_n = b_{n-1} + n^2$ with $b_1 = 1$, determine b_2 , b_3 , and b_4 .
3. Solve the recurrence relation $a_n = 2a_{n-1} + 5$ with the initial condition $a_0 = 3$.
4. The Tower of Hanoi puzzle is described by the recurrence $T_n = 2T_{n-1} + 1$, with $T_1 = 1$. Derive the closed-form solution for T_n .

Counting Methods & Probability

1. A security code consists of 5 digits. Each digit can be any number from 0 to 9.
 - a. How many codes can be generated if no digit can repeat?
 - b. How many codes can be generated if the first digit must be even, and digits cannot be repeated?
2. A group of 10 friends are going on a trip. They decide to take a photo in the following ways:
 - a. How many ways can all 10 people line up in a row?
 - b. How many ways can they line up if two specific people always stand next to each other?
3. Two six-sided dice are rolled. What is the probability that:
 - a. The sum of the numbers is 7.
 - b. At least one die shows a 6.
 - c. The numbers on the two dice are equal.
4. A class has 15 students. A team of 4 students needs to be selected:
 - a. How many different teams can be formed?
 - b. If two specific students must be included in the team, how many teams can be formed?
5. In how many ways can the letters of the word "STATISTICS" be arranged?
 - a. How many of these arrangements start with the letter "S"?
 - b. How many arrangements have all the "T"s together?



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Permutations and Combinations

1. A password consists of 8 characters, chosen from the set {A, B, C, D, 1, 2, 3, 4, !, @, #, \$}.
 - a. How many passwords can be formed if repetition of characters is not allowed?
 - b. If the password must start with a letter and end with a digit, how many passwords can be formed?
2. From the word "ENGINEERING," how many unique arrangements can be made:
 - a. Without any restrictions?
 - b. If all the "E"s must be together?
3. 8 beads of different colors are to be strung together to form a circular necklace.
 - a. How many distinct arrangements can be made?
 - b. If the necklace is symmetrical (indistinguishable when flipped), how many arrangements are possible?
4. A committee of 6 members is to be formed from a group of 10 men and 8 women.
 - a. How many committees can be formed if there are no restrictions?
 - b. How many committees can be formed if the committee must have at least 2 women?
5. A class of 30 students is divided into three groups for a project: one group of 10 students, one group of 12 students, and one group of 8 students.
 - a. How many ways can the class be divided into these groups?
 - b. If one specific student must be in the group of 10, how many ways can the division be done?
6. A bakery sells 10 different types of cakes. A customer wants to buy 5 cakes.
 - a. How many ways can the customer choose the cakes if the selection is such that at least one of each type must be chosen?
 - b. How many ways can the cakes be chosen if there is no restriction on the number of cakes of each type?



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Pigeonhole Principle

1. Show that if 50 integers are chosen from the set $\{1, 2, 3, \dots, 99\}$, at least two of them are consecutive.
2. Prove that in any group of 9 positive integers, there are two integers whose difference is divisible by 8.
3. In a set of 30 students, prove that at least two students were born in the same day of the week.
4. Prove that if 9 socks are drawn from a drawer containing 4 red socks, 4 blue socks, and 4 green socks, at least three socks must be of the same color.