# Practice Sheet
## Combinatorics and Pigeonhole Principle

**Combinatorics:**

1. Find the number of different words that can be formed by rearranging the letters in the following words:
    a. MISSISSIPPI.
    b. NORMAL
    c. ABOMINABLE
    d. MONKEYDLUFFY
    e. FMALCHEMIST
2. Make all arrangement of letters of the word VINSMOKESANJI so that
    a) M is always next to O
    b) M and O are always together
3. Consider a license plate of 8 letters, where the first 4 letters include only alphabets and the last 4 letters include digits only. How many license plates can be made in this way if the alphabet comes from your name and digits come from your Student ID?
4. Find the total number of 3 digit numbers possible from the digits of your Student ID.
5. A box contains 12 black and 8 green marbles. How many ways can 3 black and 2 green marbles be chosen?
6. 8 students on a student council are assigned 8 seats around a U-shaped table.
    a. How many different ways can the students be assigned seats at the table?
    b. How many ways can a president and a vice-president be elected from the 8 students?
7. A Club consists of 20 members, of which 9 are male and 11 are female.Seven members will be selected to form an event-planning committee. How many committees of 4 females and 3 males can be formed?
8. In how many ways can a cricket eleven be chosen out of a batch of 15 players if-
    a)There is no restriction on the selection.
    b) One Particular Player is always chosen.
    c)Two Particular Players are never chosen.
9. How many ways are there to seat 10 people, consisting of 5 couples, in a row of seats (10 seats wide) if
    a. The seats are assigned at random
    b. All couples are to get adjacent seats

10. In how many ways can 5 boys and 4 girls be arranged on a bench if
    a. Boys and girls alternate?
    b. Anne and Jim wish to stay together?
11. In a playground, 3 sisters and 8 other girls are playing together. In a particular game, how many ways can all the girls be seated in a circular order so that the three sisters are not seated together?

**Pigeonhole principle:**

1) Show that in a group of 20 people and friendship is mutual, show that there exist two people who have the same number of friends?
2) The population of the US is 300 million. Every person has written somewhere between 0 and 10 million lines of code. What's the maximum number of people that we can say must have written the same number of lines of code?
3) Three people are running for student government. There are 202 people who vote. What is the minimum number of votes needed for someone to win the election?
4) Briar the cat likes to wear socks on all four of its feet. Briar's sock drawer is filled with yellow, white, and pink socks. Every morning Briar pulls socks out of the drawer one at a time until four matching socks are found. What is the largest number of socks Briar may pull from the drawer before finding a complete set?
5) Tammy notices that whenever she selects 7 whole numbers, there is always a triple a, b, c of numbers in her collection that all differ from each other by a multiple of 3. Tammy conjectures this will always be the case. Prove Tammy's conjecture
6) There are 38 different time periods during which classes at a university can be scheduled. If there are 677 different classes, what is the minimum number of different rooms that will be needed?