Assignment for Mid Term

1. Let p and q be the propositions
   p : You drive over 65 miles per hour.
   q : You get a speeding ticket.

Write these propositions using p and q and logical connectives .
a) You do not drive over 65 miles per hour.
b) You drive over 65 miles per hour, but you do not get a speeding ticket.
c) You will get a speeding ticket if you drive over 65 miles per hour.
d) If you do not drive over 65 miles per hour, then you will not get a speeding ticket.
e) Driving over 65 miles per hour is sufficient for getting a speeding ticket.
f) You get a speeding ticket, but you do not drive over 65 miles per hour.
g) Whenever you get a speeding ticket, you are driving over 65 miles per hour.

2. Let p, q, and r be the propositions
   p : You get an A on the final exam.
   q : You do every exercise in this book.
   r : You get an A in this class.

Write these propositions using p, q, and r and logical connectives (including negations).
a) You get an A in this class, but you do not do every exercise in this book.
b) You get an A on the final, you do every exercise in this book, and you get an A in this class.
c) To get an A in this class, it is necessary for you to get an A on the final.
d) You get an A on the final, but you don't do every exercise in this book; nevertheless, you get an A in this class.
e) Getting an A on the final and doing every exercise in this book is sufficient for getting an A in this class.
f) You will get an A in this class if and only if you either do every exercise in this book or you get an A on the final.

3. Let p, q, and r be the propositions
   p : Grizzly bears have been seen in the area.
   q : Hiking is safe on the trail.
   r : Berries are ripe along the trail.

Write these propositions using p, q, and r and logical connectives (including negations).
a) Berries are ripe along the trail, but grizzly bears have not been seen in the area.

b) Grizzly bears have not been seen in the area and hiking on the trail is safe, but berries are ripe along the trail.
c) If berries are ripe along the trail, hiking is safe if and only if grizzly bears have not been seen in the area.
d) It is not safe to hike on the trail, but grizzly bears have not been seen in the area and the berries along the trail are ripe.
e) For hiking on the trail to be safe, it is necessary but not sufficient that berries not be ripe along the trail and for grizzly bears not to have been seen in the area.
f) Hiking is not safe on the trail whenever grizzly bears have been seen in the area and berries are ripe along the trail.

4. Let p denote "Henry eats halibut," q denote "Catherine eats kippers," and r denote "I'll eat my hat." Write a proposition that reads “if the moon is made of cheese then basketballs are round,” and “if spiders have eight legs then Sam walks with a limp” . Draw the combinational circuit diagram of the above statement .

5. De Morgan’s laws say that $\neg(p \vee q)$ is equivalent to $\neg p \wedge \neg q$ and that $\neg(p \wedge q)$ is equivalent to $\neg p \vee \neg q$. Use truth tables to demonstrate that De Morgan’s laws are correct.
6. Show that if there are 30 students in a class, then at least two have last names that begin with the same letter.
7. 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?
8. A bowl contains 10 red balls and 10 blue balls. A woman selects balls at random without looking at them.

   a) How many balls must she select to be sure of having at least three balls of the same color?

   b) How many balls must she select to be sure of having at least three blue balls?

9. Find the minimum number of students in a class to be sure that six of them are born in the February month of a leap year.
10. A basket contains 20 red cubes and 20 blue cubes. A woman selects cubes at random without looking at them.
11. How many cubes must she select to be sure of having at least **M** cubes of the same color?

M = the sum of first and last digit of your University ID

12. $[(p \rightarrow q) \wedge (r \rightarrow s)] \rightarrow [(\neg q \vee \neg s) \rightarrow (\neg p \vee \neg r)]$ tautology or not. Draw a tree of the following statement.
13. Construct the truth table for the compound proposition below:

$(p \rightarrow q) \wedge [(q \wedge \neg r) \rightarrow (p \vee r)]$

Draw a tree of the following statement.

14. Prove or Disprove

I. $[p \rightarrow (q \rightarrow r)] \leftrightarrow [(p \rightarrow q) \rightarrow (p \rightarrow r)]$

Il. $[(p \rightarrow q) \rightarrow r] \leftrightarrow [p \rightarrow (q \rightarrow r)]$

Ill. $[(p \leftrightarrow q) \leftrightarrow r] \leftrightarrow [p \leftrightarrow (q \leftrightarrow r)]$

15. $p \rightarrow (\neg q \wedge \neg p) \leftrightarrow \neg q$ show the truth table. Draw a tree of the following statement.
16. Write down the working procedure of the Binary search algorithm and Bubble search algorithm.
17. What is complexity? Write down the complexity of the Bubble sort algorithm and Binary search algorithm.
18. Array = [6, 5,2,20,A,38,11]

Here, **A** = last two digit of your University ID

Sort the array using the Bubble sort algorithm.

19. Array = [100, 29,4,56,7, M,99,100]

Here, **M** = the sum of last two digits of your University ID

Sort the array using the Bubble sort algorithm.

20. Array = [100, 29,4,56,7, M,99,100]

Here, **M** = the sum of last two digits of your University ID

Search M from the array using the Binary Search algorithm.