Set Numbers

Roll No	First name	Set Number
2021csc1060	ANURAG	1
2021csc1049	PRACHI	2
2021csc1047	SAHIL	1
2021csc1041	AGAMJYOT SINGH	2
2021csc1021	VIVEK	1
2021csc1042	ARMAAN	2
2021csc1046	SONAL	1
2021csc1045	SHASHWAT SHEEL	2
2021csc1043	REYA KAUR	1
2021csc1033	HEMENDRA SINGH	2
2021csc1064	TANISHQA	1
2021csc1039	DEEPTI	2
2021csc1066	ISHANT	1
2021csc1026	VINAYAK	2
2021csc1050	ADITYA	1
2021csc1027	ISHITA	2
2021csc1017	TEENU	1
2021csc1008	BABLEEN	2
2021csc1058	JASPREET	1
2021csc1031	KAMALPREET	2
2021csc1009	KARAMJOT	1
2021csc1012	TARLEEN	2
2021csc1055	YUVRAJ	1
2021csc1056	RAVLEEN KAUR	2
2021csc1071	RITIK	1
2021csc1032	ANIKA	2
2021csc1035	GURVANSH SINGH	1
2021csc1079	Mahirullah	2
2021csc1065	ABHAY	1
2021csc1084	Pranav	2
2021csc1080	Sohrab	1
2021csc1081	ABDUL	2
2021csc1063	BHAVKIRAT SINGH	1
2021csc1054	AONUSHA	2
2021csc1019	PRABH SINGH	1
2021csc1059	ARSH SINGH	2
2021csc1051	MAYANK	1
2021csc1040	RIYA	2
2021csc1069	DASHMEET	1
2021csc1072	DIVYANSH	2
2021csc1018	GUNJAN	1
2021csc1024	GUNRAJ	2

2021csc1001	GURTEJ	1
2021csc1029	HARJOVAN	2
2021csc1083	HARMEET	1
2021csc1013	HARVIJAY	2
2021csc1014	JASKIRAT	1
2021csc1006	NAVJOT	2
2021csc1062	RHEHAT	1
2021csc1010	SAHEJPREET	2
2021csc1038	SUKHDEEP	1
2021csc1082	TAJBIR	2
2021csc1074	VISHAL	1
2021csc1070	SAUMYA	2
2021csc1068	SURYANSH SINGH	1
2021csc1025	SWASTI	2
2021csc1028	MANAV	1

Theory Assignment

Discrete Structures

Set 1

1. Solve:

Let $\mathbb{R}$ be the set of real numbers, $\mathbb{R}^+$ the set of non-negative real numbers, and $\mathbb{Z}$ the set of integers. Let also f: $\mathbb{R} \rightarrow \mathbb{R}$, g: $\mathbb{R} \rightarrow \mathbb{R}^+$, and h: $\mathbb{R} \rightarrow \mathbb{Z}$ be 3 functions defined as follows:

$$f(x) = 5x+12,\ g(x) = \sqrt{x^2+1},\ \text{and } h(x) = \left\lfloor \frac{x+1}{4} \right\rfloor.$$

a) Prove that f is one-to-one and onto, and find f^{-1}.
b) Is g one-to-one? Onto? Prove your answer.
c) Is h one-to-one? Onto? Prove your answer.
d) Calculate $h \circ g(x)$, $g \circ h(x)$, $(f \circ h) \circ g(x)$, and $f \circ (h \circ g)(x)$.
e) Given two sets E and F, a function v: E→F, and an element y ∈ F, define $v^{\leftarrow}(y)$ to be the following set: $v^{\leftarrow}(y) = \{x \in E \mid v(x) = y\}$. Determine $f^{\leftarrow}(1)$, $g^{\leftarrow}(3)$, $g^{\leftarrow}(0)$, $h^{\leftarrow}(2)$.

2. Solve the following recurrence relation (that is, compute a_r in terms of r alone.

   $a_0 = -3$, $a_r = 6a_{r-1} + 10a_{r-2}$ for $r >= 1$

3. Solve using Master's Theorem: $T(n) = 5T(2n/5) + 1$
4.

Let p denote the statement, "The material is interesting" and q denotes the statement,

"The exercises are challenging" and r denotes the statement, "The course is enjoyable".

Write the following statements in symbolic form :

Write the following statements in symbolic form:

- The material is interesting, and the exercises are challenging
- If the material is not interesting and the exercises are not challenging, then the course is not enjoyable
- Either the material is interesting, or the exercises are not challenging nut not both.

5. Let B = {001, 010, 011, 100, 101}. Does B have a maximum? Does B have a maximal? Consider a tree that has 2 vertices of degree 2, 1 vertex of degree 3, and 3 vertices of degree 4. How many vertices of degree 1 does it have?
6. In a film festival, 9 films are to be staged, 5 in a day for 3 days. In how many ways could the films be staged?

7.

For each of the following, circle *each statement that is true (that could be zero, one, or more for each question).* Each problem is worth 1 point and you only get the points if you circle all of the correct answers and none of the wrong ones.

a) If A and B are both **un**countably infinite sets, then A-B could be

Countably infinite **Uncountably infinite** **Finite**

b) If A and B are both **un**countably infinite sets, then $A \cup B$ could be

Countably infinite **Uncountably infinite** **Finite**

c) If A is a countably infinite set and B is a countably infinite set, then A-B could be

Countably infinite **Uncountably infinite** **Finite**

d) $(Z \times Z \times Z) - (R^{+} \times R^{+} \times R^{+})$ is

Countably infinite **Uncountably infinite** **Finite**

e) $\phi \times Z \times R$ is

Countably infinite **Uncountably infinite** **Finite**

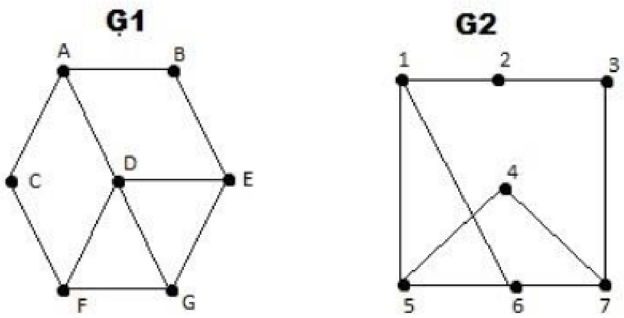
<u>Theory Assignment</u>

Discrete Structures

Set 2

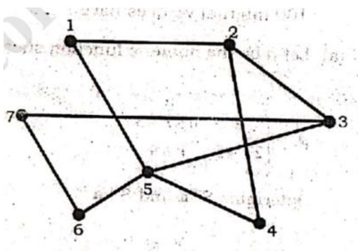
1.

For the following given graphs G1 and G2, show whether G1 and G2 are isomorphic? Find the adjacency matrix for the given graphs G1 and G2. Determine whether G1 and G2 are planar. If yes, redraw. Else, give reasons. Tell whether it is possible to draw a tree for each graph G1 and G2 by removing at most two edges with the vertex A in G1 and vertex 4 in G2 as the root node? Justify your answer.



2. Solve using Master's theorem: T(n) = T(9n/10)+ n
3. Solve the following recurrence relation (that is, compute a_r in terms of r alone.
   $a_0 = 9$, $a_1 = 15$, $a_r = 7a_{r-1} - 12a_{r-2}$ for r>= 2

4. Is the given graph bipartite? If yes, give the bipartition.



5. Thirteen people on a softball team show up for a game.

   a. How many ways are there to choose 10 players to take the field?
   b. How many ways are there to assign the 10 positions by selecting players from the 13 people who show up?
   c. Of the 13 people who show up, three are women. How many ways are there to choose 10 players to take the field if at least one of these players must be a woman?

6.

Let P, Q and R be the propositions as follows : 3

P : You go to school.

Q : You appear in the exam.

R : You pass the exam.

Write the following in symbolic form:

- You do not go to school and you do not appear in the exam
- If you do not go to school and do not appear for the exam, then you do not pass the exam
- You go to school and you appear in the exam but you do not pass the exam

7. Given A = {p, q, r, s}. Let R be the relation defined on A as:
   R = { (p, p), (q, q), (q, r), (r, q), (s, q), (s, s)}
   Draw a diagraph. Is R an equivalence relation? Justify your answer.
   Assume f(x) = x2 +2x +4 and g(x) = 4x-5. Find the following compositions:
   (i) f o g
   (ii) g o f
   (iii) f o f and
   (iv) g o g