



☐ Sessional-1 ☐ Sessional-II ☒ **Terminal Examination – SPRING 2017**

Course Title:	Discrete Structures			Course Code:	CSD101	Credit Hours:	3(3,0)
Course Instructors:	Mahwish Waqas, Fareeha Ifkhar, Iqra Obaid, Muhammad Adnan, Muhammad Ali Khan			Programme Names:	BS(SE), BS(CS)		
Semester:	2 nd	Batch:	FA16-BSE FA16-BCS	Sections:	A, B, C, E A, B, C, D, E, F, G, H	Date:	
Time Allowed:	03 Hours			Maximum Marks:	100		
Student's Name:				Reg. No.:	CIIT/- - -		

Important Instructions / Guidelines:

- Do not open this exam booklet until you are directed to do so.
- Write your **name** and **Student registration No.** clearly on the first page. Please encircle your section above.
- All questions are compulsory
- Plan your time wisely. Do not spend too much time on one problem. Read through all of them first and then answer them in order that allows you to make the most progress.
- Use the space provided for solution of question. If you need more space, you can use extra sheets. In case of extra sheet, clearly mention question number of answer you are giving. Use last blank sheet of the paper for rough work.
- **Do show all intermediate steps while solving a question.**
- These instructions must be followed strictly. Failure to do so may result in serious grade loss.
- You are not allowed to:
 - Talk to anyone once the exam begins.
 - Leave the exam room and then return.
 - Think in the air or see here and there.
- You can use calculator. Cell phones not allowed.
- This is a close-book and close-notes exam. You can't share any resource.

Question No.	Obtained Marks	Maximum Marks
1		10
2		5
3		10
4		14
5		15
6		10
7		10
8		10
9		10
10		6
Total		100

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Question 2

[Marks: 5]

Using Proof by Contraposition show that, if $n^3 + 9$ is even then n is an odd integer.

Question 3

[Marks: 4+6= 10]

a) Consider the following recursive definition:

[Marks: 5]

$$A(m, n) = \begin{cases} 6 & \text{if } m < n \\ A(m - n, n + 4) + m & \text{if } m \geq n \end{cases}$$

Find the value of $A(41, 2)$.

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b) Find the explicit and recursive formula for each of following sequence;

i. $-31, -14, 3, 20, 37, 54, \dots$

ii. $1/5, 1/25, 1/125, 1/625, \dots$

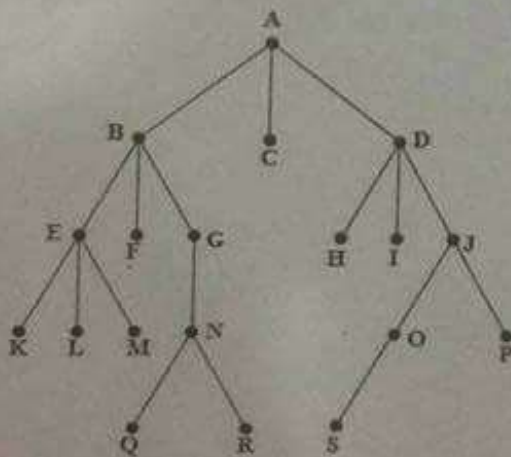
iii. $17, 10, 3, -4, -11, -18, \dots$

Question 4

[Marks: $8+3+3=14$]

a) Consider the following rooted tree:

[$4 \times 2 = 8$]



Answer the following questions:

i. Give the post-order traversal of rooted tree.

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ii. Give the in-order traversal of rooted tree.

b) Find the value of the following prefix expression.

* - 6 + 4 - 3 1 3 4 2

c) Find the value of the following postfix expression.

6 5 * 2 1 4 3 + 6 2 / * -

Question 5

[Marks: 5+5+5=15]

a) Draw a directed graph from the following adjacency matrix:

[5]

$$\begin{bmatrix} 0 & 1 & 2 & 1 \\ 0 & 1 & 1 & 2 \\ 0 & 1 & 1 & 2 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

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- b) Construct the intersection graph of the following where $\mathbb{Z}$ and $\mathbb{N}$ denote the set of integers and natural numbers, respectively.

[5]

$$A_1 = \{x \mid x \in \mathbb{N}, 0 < x < 10\}$$

$$A_2 = \mathbb{N}$$

$$A_3 = \{x \mid x \in \mathbb{Z}, x < 0\}$$

$$A_4 = \{x \mid x \in \mathbb{Z}, 2x+1\}$$

$$A_5 = \{x \mid x \in \mathbb{N}, x > 10\}$$

- c) Draw an undirected graph from the following incidence matrix:

[5]

	e_1	e_2	e_3	e_4	e_5	e_6	e_7	e_8
v_1	0	0	0	1	0	1	0	0
v_2	0	0	0	0	1	1	1	1
v_3	0	0	0	0	0	0	0	1
v_4	1	1	1	0	1	0	0	0
v_5	0	0	1	1	0	0	1	0
v_6	1	1	0	0	0	0	0	0

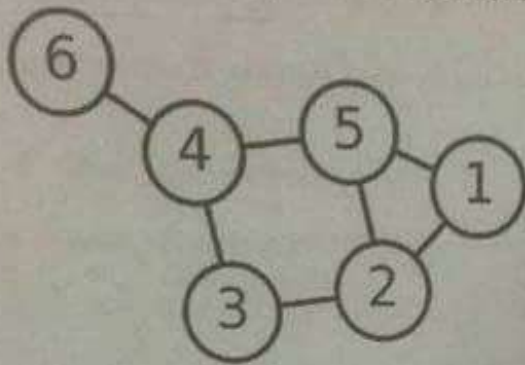
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Question 6

[Marks: 10]

Answer the following questions using the graph sketched below:



a) Find the distance matrix of the above graph.

[4]

b) What is the degree of each vertex?

[2]

c) What is the eccentricity of each vertex?

[2]

d) What is the diameter and radius of the graph?

[2]

M.C.



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Question 7

[Marks: 2*5=10]

For each of the following relations on $\{1, 2, 3, 4\}$,

- Find out the ordered pairs defined by the relation.
- Determine whether relation is an equivalence relation or not by using matrices. If relation is not an equivalence relation then state the reason for it.

a) $R_1 = \{(x, y) | x < y\}$

b) $R_2 = \{(x, y) | 2 \text{ divides } (x + y)\}$

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Question 8

[Marks: 4+6=10]

Given $X = \{20, 50, 0, 90, 110, 180, 410, 710\}$, $Y = \{1, 2, 3, 4, 5, 7, 9, 10\}$, and function $g: X \rightarrow Y$ where for any $n \in X$,

$$g(n) = \left\lceil \frac{\sqrt{n+5}}{3} \right\rceil$$

a) Identify the followings:

[1+1+2=4]

- i. Domain of g .
- ii. Co-domain of g .
- iii. Range of g .

b) For each of the following classifications, either prove that g is this kind of function or explain why not and propose a small change to X or Y to make it so g fits the classification:

[2*3=6]

- i. Injection
- ii. Surjection
- iii. Bijection