

UNIVERSITY OF RUJUNA

BACHELOR OF SCIENCE (GENERAL) DEGREE LEVEL (SEMESTER II)
EXAMINATION – NOVEMBER/DECEMBER 2016

SUBJECT : COMPUTER SCIENCE

COURSE UNIT: COM 1213/COM121β (Data Structures & Algorithms)

TIME: 2 hours

Answer four (04) questions including question one (01).

1.

- a. Calculate the time complexity of the *Bubble sort* algorithm for a given array A of n elements.
- b. Write a situation where *Merge sort* is the best algorithm to use. Justify your answer.
- c. Write the algorithm for *Selection sort*.
- d. Consider the following number set.
47, 20, 54, 7, 32, 18, 59, 27, 61, 2
 - i. Sort the numbers in ascending order using *Insertion sort*. Show intermediate steps clearly.
 - ii. Search the value 54 using *Binary search* algorithm. Show intermediate steps clearly.

2.

- a.
 - i. Write two (02) applications of stack ADT.
 - ii. Describe the output of the following series of stack operations giving the content of the stack after each operation.
push (5), push (3), pop (), push (2), push (8), pop (), pop (), push (9),
push (1), pop ()
- b. What is the drawback in a normal queue ADT which is addressed by a circular queue ADT?
- c. Explain the concept of a priority queue and discuss a situation where this can be useful.
- d.
 - i. Draw a min heap whose keys are all the odd numbers from 1 to 20 (with no repeats)
 - ii. Redraw the above binary heap after deleting the minimum value. Show intermediate steps clearly.

Continued...

3.

- a. Write two (02) advantages of using a linked list over an array in implementing Stack ADT.
- b. Explain following operations in a singly linked list by providing suitable illustrations.
 - i. Delete a node from the list where it is having only one node.
 - ii. Remove the first node from the linked list.
 - iii. Remove the last node from the linked list.
- c.
 - i. What is the drawback of a singly linked list which is addressed by a doubly linked list?
 - ii. Draw the structure of a doubly link list node.
- d. Consider the following scenario and propose an appropriate linked list to implement the given scenario.

Suppose there are multiple applications running on a PC. Therefore, the operating system will put the running applications on a list and gives a fixed time slot to all for running. The operating system keeps on iterating over the list until all the applications are completed.

4.

- a. What is the main property of a strictly binary tree?
- b. Consider following elements.

62, 24, 30, 12, 68, 76, 78, 65, 70, 63, 67,
8, 20, 27, 32

- i. Construct a binary search tree.
 - ii. Delete 24 from the tree and give two separate resulting trees that can be obtained after deleting the node.
 - iii. Write post order traversal for one of the above resulting trees, given in (ii).
- c. Consider the following expression.
$$((3 + 4) * (8 + 1 - 4)) / ((4 * 3) - (2 * 2))$$
 - i. Draw an expression tree for the above expression.
 - ii. Write the equivalent prefix and postfix expressions.
 - d.
 - i. Write the structural properties of an AVL tree.
 - ii. Construct an AVL tree for the following elements, showing intermediate steps clearly.

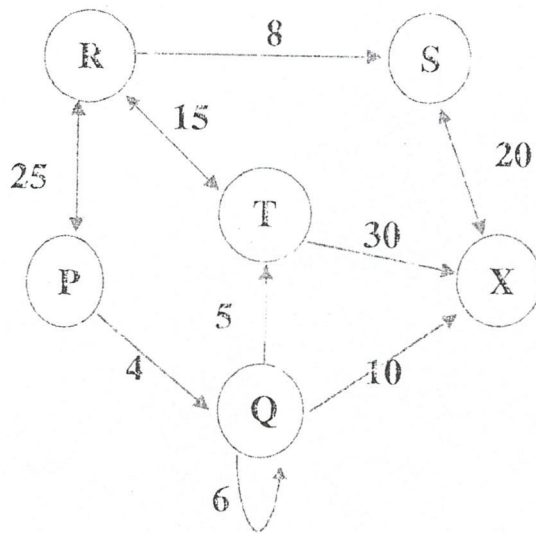
12, 14, 15, 18, 22, 24, 28

Continued...

- a.
- Suppose G_1 is a complete graph with 5 vertices. Write the formal definition of the graph G_1 .
 - Draw the graph corresponding to the above specification.
- b. Draw the corresponding directed graph for the following adjacency matrix.

	A	B	C	D	E	F
A	0	1	1	0	1	0
B	1	0	0	1	0	1
C	0	0	0	1	0	0
D	0	0	0	1	0	0
E	1	0	0	0	0	1
F	0	1	1	0	1	0

- c. Consider the following weighted graph.



- Write the adjacency matrix for the above given graph.
 - Write the adjacency list for the given graph.
- d.
- Explain a situation where a collision can occur in a hash table.
 - Write three (03) methods of collision resolution.
 - Insert the following elements into a hash table assuming that $TableSize = 7$ and the hash function is $h(k) = k \% TableSize$.
18, 21, 75, 48, 52

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