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RAJARATA UNIVERSITY OF SRI LANKA

FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree in Information and Communication Technology

First Year Semester II Examination - February/March 2019

ICT 1305 – DATA STRUCTURES

Time: Three (03) hours

Instructions

Answer **All Five** Questions.

Paper consists with **three** (03) pages.

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1. a. Explain the importance of having a good knowledge in data structures in computer programming. (05 marks)

   b. What are the factors you should consider when measuring the efficiency of an algorithm? (04 marks)

   c. Discuss the advantages and disadvantages of using arrays as data structures. (04 marks)

   d. A chessboard is a square board containing 8x8 cells over which the chess pieces are laid. A chess piece has a name, a color, and position (row number and column number). A chess set contains 16 white pieces and 16 black pieces. Suggest a suitable data structure to model a chessboard and its pieces. Indicate your assumptions if any.

   (07 marks)

   [Total 20 marks]

2. a. Explain how to utilize the space of a fixed size array based circular queue, using examples. (04 marks)

   b. Compare and contrast singly linked lists and doubly linked lists. (04 marks)

c. Write the node definition of a doubly linked list. (04 marks)

d. Assume that nodeC is a node in a doubly linked list. Write the required lines of C codes to insert a node after the nodeC. (04 marks)

e. Write the required lines of C codes to delete the nodeC in d. above. (04 marks)

[Total 20 marks]

3. a. Explain the relationship between the nodes in a priority queue using examples. (03 marks)

b. Explain the processes of percolating up elements and percolating down elements in priority queues. (04 marks)

c. Explain how the highest priority element is removed from an *array-based heap*. (04 marks)

d. Insert the given list of integers [15, 12, 4, 20, 18, 2, 10 ,5] in to an array-based priority queue. Illustrates the steps clearly. (05 marks)

e. Explain the binary search algorithm and find its time complexity. (04 marks)

f. Illustrate how to sort the given list of integers [15, 12, 4, 20, 18, 2, 10 ,5] using *selction sort* algorithm. (04 marks)

[Total 24 marks]

4. a. Formally define a binary search tree (BST). (03 marks)

b. Define the following terms in terms of Binary Search trees,

i. Complete tree
ii. Simple path
iii. Tree height
iv. Skewed tree (04 marks)

c. Insert the numbers 20,15,35,18,30,7,44,18,33,23 and 1 into a binary search tree and draw its shape. (04 marks)

d. Suggest a suitable algorithm to print the elements of each layer in a BST. (05 marks)

e. What are the cases you have to consider when deleting a node of a BST? Explain them using examples. (04 marks)

[Total 20 marks]

5. a. What are the properties of an AVL tree? (02 marks)

b. Explain how to maintain the balance of an AVL tree after inserting an element. (05 marks)

c. Devise an algorithm to convert a given infix expression to a postfix expression. (05 marks)

d. Apply the algorithm in c. above to convert the infix expression; (A+2*B)*(C^2-D)-E+F/G*((H+3*I)/2) to postfix. Illustrate the steps clearly. (04 marks)

[Total 16 marks]

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