

THE OPEN UNIVERSITY OF SRI LANKA
B.Sc DEGREE PROGRAMME: LEVEL 04
DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE
FINAL EXAMINATION - 2014/2015
CSU2279: DATA STRUCTURES AND ALGORITHMS



DURATION: **THREE HOURS** (3 HOURS)

Date: **25th October, 2015**

Time: **1.30 p.m – 4.30 p.m**

Answer FOUR Questions ONLY.

Q1.

- a) What is an Algorithm?
- b) What is a Data Structure? Give **three (03)** examples.
- c) List down **three (03)** basic operations that can be performed with a data structure.
- d) What are the **five (05)** main steps involved when writing a computer program to solve a given problem?
- e) What are the aspects you should consider when selecting an algorithm for implementation?
- f) Explain the factors on which the running time of a program depends on.

Q2.

- a) Sorting methods can be classified into **two (02)** categories. What are those? Briefly explain them.
- b) Write a Pascal program to implement the *Bubble sort* algorithm.
- c) Compare and contrast the *Bubble sort* algorithm with the *Quick sort* algorithm.
- d) Explain how *Straight Selection sort* works on the following set of integers, when sorting them in to ascending order.

30, 11, 42, 23, 54, 92, 80, 61

Q3.

- a) Describe what do you mean by **Abstract Data Type (ADT)**
- b) Define the term “Encapsulation” with respect to ADT.
- c) What are the advantages of the *Doubly-linked list* compared to the *Singly linked list*?
- d) Explain **two (02)** disadvantages of *doubly-linked lists*?
- e) Explain the process of the following question (i) and (ii) by means of appropriate diagrams. (Show the pointer manipulations clearly)
 - i. Deleting an element from the **beginning** of the singly linked list
 - ii. Inserting an element into the **end** of a singly linked list.
- f) State whether the following statements are *true* or *false*, if it is *false* give the reason.
 - i. A pointer is a *cell* whose value indicates another cell.
 - ii. In singly linked list data structures a cell has two components; they are *value of the cell* and the *pointer value which refers to the previous cell*.
 - iii. In the pointer representation of a data structure, the *header* cell has the *address of the first cell*.

Q4.

- a) How does *Stack data structure* differ from a *Queue data structure*?
- b) A stack has two basic operations called **PUSH** and **POP**, using an array implementation of stacks write a Pascal procedure/ function to implement those operations on Stacks.
- c) With a suitable diagram for each part, show how elements are organized in the Queue. (**Note: clearly indicate the values of front and rear variables and array indexes in diagram**)
 - (i). Add **three (03)** integer elements **20, 40 & 60** to the Queue.
 - (ii). Dequeue one element from the Queue.
 - (iii). Make Queue empty.
- d) What is the main problem regarding *Linear Queues*?
- e) Using an appropriate diagram explain the circular array implementation of a Queue.

Q5.

a. Define the following String operations.

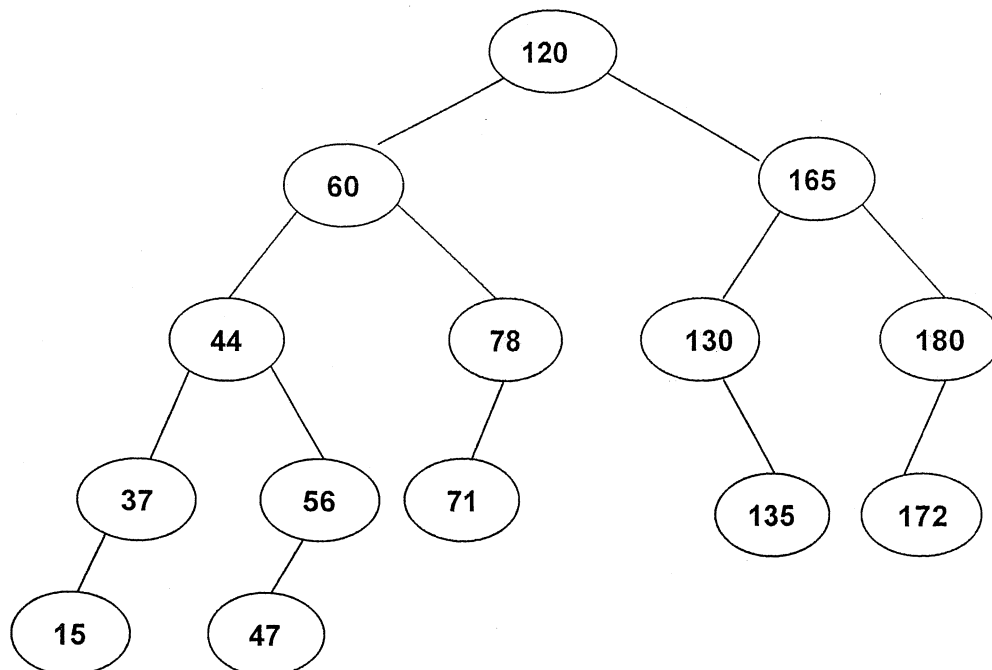
- i. POS(S1, S2)
- ii. COPY(S1, p, 1, S2)
- iii. LENGTH(S1)
- iv. CONCAT(S1, S2, S3)

b. What is a **Set**? What do set *union*, *difference* and *intersection* mean?

c. Write Pascal procedures/functions to implement the following Set operations.

- i. INISET(S): A procedure to initialize the set S.
- ii. UNIONSETS (S1, S2): A procedure to create the union of the two sets, S1 and S2.
- iii. INTERSECTS (S1, S2): A procedure to create the intersection of the two sets, S1 and S2.

Q6.

a. Using the following *Figure 1*, explain the following terms.*Figure 1*

- | | |
|---------------------------|----------------------------|
| i. Root | vi. Level of a binary tree |
| ii. Leaf nodes | vii. Sub tree |
| iii. Degree of a node | viii. Ancestors |
| iv. Degree of a tree | ix. Siblings |
| v. Depth of a binary tree | x. Forest |

b. Answer the following questions using the following Binary tree structure B1 (figure 2).

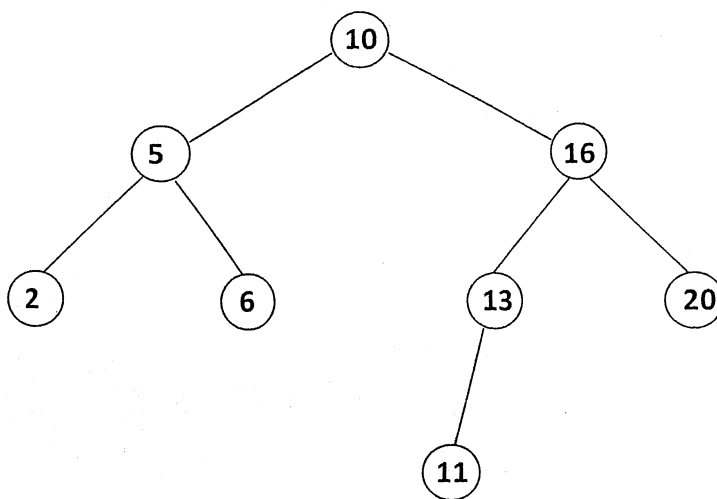


Figure 2: B1 tree

- Give the preorder, inorder, postorder transversal of the tree B1.
- Is B1 a binary tree? Justify your answer.
- Show B1 after inserting the 9th node. Explain the concept that you used when inserting the 9th node. (Call the resultant tree B2)
- Is B2 a strictly binary tree structure? Justify your answer.

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