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**University Examinations 2015/2016**

SECOND YEAR, FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE, BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY, BACHELOR OF SCIENCE IN COMPUTER SECURITY AND FORENSICS AND BACHELOR OF SCIENCE IN COMPUTER TECHNOLOGY

**CCS 3200: DATA STRUCTURES AND ALGORITHMS**

**DATE: NOVEMBER 2015 TIME: 2 HOURS**

**INSTRUCTIONS:** *Answer question* ***one*** *and any other* ***two*** *questions*

**QUESTION ONE (30 MARKS)**

1. Discuss any **two** characteristics of an algorithm (2 Marks)
2. Describe the following terms as used in data structures and algorithms (6 Marks)
3. Abstract Data Type (ADT)
4. Algorithm efficiency
5. Growth rate
6. State any **four** orders of algorithm rate. Compare growth rate using simple diagram (6 Marks)
7. Explain best worst case analysis of algorithm and explain circumstance under which they are applicable in algorithm analysis. (6 Marks)
8. Declare ADT for the following data structures (6 Marks)
9. Stack
10. Queue
11. Outline algorithm for bubbles sort. (4 Marks)

**QUESTION TWO (20 MARKS)**

1. Briefly describe the following algorithms. (6 Marks)
2. Greedy algorithms
3. Travelling sales man algorithm
4. Huffman coding
5. Given the following as element of a tree 12, 5, 4, 5, 2, 8, 3, 7, 13, 0, 19 and 9.
6. Construct a binary search tree for above tree. (6 Marks)
7. Show output of above tree traversal using the following traversal orders, in order pre -order and post-order of the tree. (4 Marks)
8. Use big **O** asymptotic notation to represent f(N) where **f(N)=5n3 + n2 +17** (4 Marks)

**QUESTION THREE (20 MARKS)**

1. Consider the following elements and their associated probabilities.

|  |  |
| --- | --- |
| **Element.** | **Probability** |
| N | 15 |
| E | 30 |
| P | 8 |
| E | 19 |
| T | 21 |
| X | 7 |

1. Generate the Huffman tree for the elements (8 Marks)
2. Give the corresponding code for each element (3 Marks)
3. Give **one** area within a computer system where the queue ADT is used and justify why it is the most appropriate for that application (2 Marks)
4. Differentiate between a priority queue and an ordinary queue (2 Marks)
5. Describe the heap ADT and how it may be used in the implementation of heap sort. Use a relevant example to illustrate. (5 Marks)

**QUESTION FOUR (20 MARKS)**

1. Describe the following types of tree (6 Marks)
2. Minimal spanning tree
3. AVL
4. Red black tree
5. Compare data structures implementation using arrays and linked list. State advantages as well as limitation of each and also state application area of each. (8 Marks)
6. Write a program that compute simple interest. User is prompted for inputs and result displayed on the screen. Determine the running time of the program. Represent running time using big O notation. (8 Marks)

**QUESTION FIVE (20 MARKS)**

1. Binary search tree structure may be used in the implementation of searching and sorting. Using the list below, do the following:

12, 7, 2, 15, 10, 13, 18, 23, 20, 17, 9

1. Generate a binary search tree for the list (6 Marks)
2. Describe how you would sort the list and give the resultant sorted list (3 Marks)
3. Describe how you would search for an element in the list, using the element 23 as an example. (3 Marks)
4. Define recursion and give the three conditions that must be met for a problem to be solved by recursion. (4 Marks)
5. What other operation is required when implementing a stack and why? (4 Marks)