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**GARISSA UNIVERSITY**

**UNIVERSITY EXAMINATION 2019/2020 ACADEMIC YEAR THREE**

**SECOND SEMESTER EXAMINATION**

**SCHOOL OF PURE AND APPLIED SCIENCES**

**FOR THE DEGREE OF BACHELOR OF INFORMATION SCIENCE**

**COURSE CODE: COM 315**

**COURSE TITLE: ALGORITHMS**

**EXAMINATION DURATION: 2 HOURS**

**DATE: 13/02/2020 TIME: 2.00-4.00 PM**

**INSTRUCTION TO CANDIDATES**

* **The examination has FIVE (5) questions**
* **Question ONE (1) is COMPULSORY**
* **Choose any other TWO (2) questions from the remaining FOUR (4) questions**
* **Use sketch diagrams to illustrate your answer whenever necessary**
* **Do not carry mobile phones or any other written materials in examination room**
* **Do not write on this paper**

**This paper consists of THREE (3) printed pages *please turn over***

**QUESTION ONE (COMPULSORY)**

1. Define algorithms and explain five characteristics of algorithms **[6 marks]**
2. Explain five application areas of algorithms **[5 marks]**
3. Explain the following notations as used in analysis of algorithms **[9 marks]**
   1. Θ-Notation
   2. Ο-Notation
   3. Ω-Notation
4. Explain the concept of divide and conquer as used in design and analysis of algorithms **[5 marks]**
5. Prove that the running time of any comparison-based algorithm for sorting an n-element sequence is Ω(n lg n) in the worst case. **[5 marks]**

**QUESTION TWO**

1. Explain how the insertion algorithms work **[4 marks]**
2. Study the algorithn below and compute its time complexity in best case scenario **[8 marks]**

INSERTION\_SORT (A)

1.     **FOR** j ← 2 **TO** length[A]   
2.             **DO**  key ← A[j]      
3.                   {Put A[j] into the sorted sequence A[1 . . j − 1]}     
4.                    i ← j − 1      
5.                    **WHILE** i > 0 and A[i] > key  
6.                                 **DO** A[i +1] ← A[i]              
7.                                         i ← i − 1       
8.                     A[i + 1] ← key

1. You are provided with the following information

Alphabet: A, B, C, D, E, F

Frequency table:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| F | E | D | C | B | A |
| 60 | 50 | 40 | 30 | 20 | 10 |

Build the Encoding Tree using Huffman’s algorithm and calculate the file size **[8 marks]**

**QUESTION THREE**

1. Define greedy algorithms and explain its characteristics **[5 marks]**
2. A company wants to supply a set of houses with electricity. To reduce costs, the company should connect the houses with a minimum-cost spanning tree.
   1. Develop an algorithm the company should adopt **[8 marks]**
   2. Compute its time complexity **[7 marks]**

**QUESTION FOUR**

1. Define dynamic programming problems and explain the elements that characterize a dynamic programming algorithm **[6 marks]**
2. An n\*n matrix can be solved by divide and conquer approach based on Strassen’s matrix multiplication.
   1. Develop an algorithm for the above situation **[7 marks]**
   2. calculate the time efficiency of the algorithm **[4 marks]**
   3. explain how you can improve the time efficiency **[3 marks]**

**QUESTION FIVE**

1. Explain FIVE factors that may affect the Execution time of a computer program. **[5 marks]**
2. Differentiate between an algorithm and a Pseudocode. **[3 marks]**
3. You have the data set to solve using binary search technique 7, 12, 30, 35, 75, 83, 87, 90, 97, 99.
   1. Calculate the time efficiency of the algorithm **[7 marks]**

Hint Equation: T(1) ≤ b

T(*n*) ≤ T(*n*/2) + c for n>1

* 1. Explain the steps in development of a dynamic programming algorithm **[5 marks]**