ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION   **SUMMER SEMESTER, 2015-2016**
TIME: 1 Hour 30 Minutes   **FULL MARKS: 75**

CSE 4403: Algorithms

Programmable calculators are not allowed. Do not write anything on the question paper.
There are **4 (four)** questions. Answer any **3 (three)** of them.
Figures in the right margin indicate marks.

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1. a) Write an algorithm to find the minimum of a given array. Calculate the complexity of the algorithm. **4+4**

   b) If we say the asymptotic bound for the equation $f(n) = 5n^2 + 8B^3 + 4$ (B is a constant) is n^3 what asymptotic notation is applicable for it? Explain your answer. **4**

   c) Find the solution to the resursion $T(n) = 8T(n/2) + n^2$ using master method. **8**

   d) The following equation is called horner's rule : $P(x) = \sum_{k=0}^{n} a_k x^k$. **5**

   Write a non-recursive algorithm to calculate the summation for the given horner's rule.

2. a) Compare dynamic programming with greedy algorithms. **5**
   b) Find the solution to the recursion, $T(n) = 2T(n/2) + n \lg n$ using substitution method. **7**
   c) Find the optimal parenthesization of a matrix-chain multiplication whose sequence of dimensions is $\langle 5, \ 10, \ 3, \ 12, \ 5, \ 50 \rangle$. **10**

   Show the calculation of m and s matrix in each recursion.
   d) Do an ordering of the following growth functions: **3**
   $n^3, \sqrt{n}, 2^n, n \lg n$

3. a) Devise a divide and conquer algorithm to calculate the mean of a given array. The algorithm may be useful when the data size is very large. However, is it possible to devise such an algorithm for median? **6+2**
   b) Discuss the solution to rod cutting problem when the rod size is 4. **7**
   c) Generate the optimal binary prefix code for the following characters using Huffman's algorithm. The frequency is given with the characters seperated by : (colon). **10**
   a : 12 b: 45, c: 13, d: 16, e: 9, f: 5

4. a) List the characteristics of dynamic programming algorithms. How do they differ from recursive solutions? Is it possible to device recursive solutions to dynamic programming problems? **8**
   b) Write a recursive version of insertion sort algorithm and comment on the complexity of it. **7**
   c) Suppose you are given a set $S = \{a_1, a_2, ..., a_n\}$ of tasks, where task a_i requires p_i units of processing time to complete, once it has started. You have one computer on which to run these tasks, and the computer can run only one task at a time. Let c_i be the **completion time** of task a_i, that is, the time (clock time) at which task a_i completes processing. Your goal is to **minimize the average** completion time $(1/n)\sum_{i=1}^{n} c_i$. Provide an algorithm and argue or provide algorithmic analysis towards its optimality. [Hint: the algorithm is one of FCFS, Shortest Job First, or RR] **10**