Uva Wellassa University of Sri Lanka
Faculty of Applied Sciences
Department of Computer Science and Informatics
CST226-2 Design and Analysis of Algorithms
Assignment 01

Instructions to candidates
Number of questions: Six (06)
Answer all questions.

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1. What is an algorithm? What are the factors to be considered when analyze the complexity of an algorithm

2. Using the RAM model, determine the total running time of the following algorithm segment. Show the steps in each statement.

```
Algorithm print_matrix(a, r, c)
{
  for i:= 1 to r do
  {   for j:= 1 to c do
        Print(a[i][j]);
     Print( "\n");
  }
}
```

3. Find the complexity of the following equations using big O notation.
   a.
      i. $T(n) = 0.003 \log_4 n + \log_2 \log_2 \log_2 n$
      ii. $T(n) = 2n + 5n^{0.5} + 2.5.n^{1.25}$
      iii. $T(n) = 50n \log_{10} n + 100n^{1.5} + 500n$
      iv. $T(n) = 100n + 0.01n^2$

   b. By using the definition of Big-O, show that the running time for term $T(n) = n^3 + 20n + 1$ is not $O(n^2)$

4. Assuming that you are the software designer who is responsible for the following application, write an algorithm for the following scenario.

   Saman is a young entrepreneur who started an organic food court. In order to have a coherent idea about the future of the business, Saman decided to have software that can predict the future assets of his business. As a part of that software, Saman expects to have an application that can predict the Account balance after five years by analyzing the pattern of his deposits and withdrawals. According to Saman's accountant, he deposits 12000/= in each day of the week except Saturdays and Tuesdays. Usually they pay salary for the workers on every 21st of each month and

so that Saman withdraws 100 000/= on 20th of every month. They buy row materials on every Tuesday. So that they withdraw 5000/= on each Tuesday of the month.

5. For each of the following recurrences, give an expression for the runtime T (n) if the recurrence can be solved with the Master Theorem.

   a. $T(n) = 4T\left(\frac{n}{2}\right) + n^2$
   b. $T(n) = 16T(\frac{n}{4}) + n$
   c. $T(n) = 2T\left(\frac{n}{2}\right) + n \log n$
   d. $T(n) = 6T\left(\frac{n}{3}\right) + n^2 \log n$

6.
   i. What is 'Dynamic Programming'?
   ii. In dynamic programming, briefly describe the two (02) ways of storing the values of a problem which can be reused using relevant examples.