Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Computer Science and Technology
200 level 2nd Semester Examination – Dec.-2018/ Jan.-2019
CST226-2 Design and Analysis of Algorithms

Uva Wellassa University

Instructions to candidates
Number of questions: Four (04)
Time allocation: Two (02) hours
Mark allocation: 100
Answer all questions.

1.

a. What is an algorithm? What are the factors to be considered when analyze the complexity of an algorithm (2 mark)

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

```
i: =1;
while (i<n) do
{
x: = x+1;
i: = i+1;
}
```

(4 mark)

c. Find the complexity of the following equations using big O notation.

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. $T(n) = 100n + 0.01n^2$

(4 mark)

d. Prove that $T(n) = 5n^3 + 10n$ is not $O(n^2)$ (3 mark)

e. Write algorithms to get the factorial value for a given number using following approaches.
i. Iterative approach
ii. Recursive approach (4 mark)

f. For each of the following recurrences, give an expression for the runtime T (n) if the recurrence can be solved with the Master Theorem.
i. $T(n) = 4T(\frac{n}{2}) + n^2$.
ii. $T(n) = T(\frac{n}{2}) + 2^n$
iii. $T(n) = 16T(\frac{n}{4}) + n$
iv. $T(n) = 2T\left(\frac{n}{2}\right) + n \log n$

(8 mark)

(48)

2.

a.

i. What is 'Dynamic Programming'? (1 mark)

ii. In dynamic programming, briefly describe the two (02) ways of storing the values of a problem which can be reused. Use relevant examples. (6 mark)

b. Write the algorithm for Longest Common Subsequence(LCS) and briefly explain the practical importance of LCS. (8 mark)

c. Illustrate the behavior of the LCS algorithm on the following two (02) lists. {B,A,C,A,D} and {A,C,C,B,A,D,C,B} (10 mark)

3.

a.

i. What are the two (02) properties of Greedy algorithms. (1 mark)

ii. Compare and contrast Greedy algorithms with Dynamic programming. (4 mark)

b. Clearly indicating the steps, find the feasible and optimal solutions for the following knapsack problem. Let number of elements (n) = 3, maximum weight(W) = 20

Item number (i)	1	2	3
Value of each item (v_i)	25	24	15
Weight of each item (w_i)	18	15	10

(10 mark)

c. ABC networking company uses a compression technique to encode the message before transmitting over the network. Suppose the message contains the following characters with their frequency.

Character	A	B	C	D	E
Frequency	24	12	10	8	8

If the compression technique used is Huffman Coding, how many bits will be saved in the message? (Clearly indicate the steps)

Note : *Each character in input message takes 1 byte* (10 mark)

4.

a. What is 'Graph' in data structure? Write the applications of graph in data structure. (3 mark)

b.

i. Briefly explain the 'Minimum Spanning Tree'. Name two (02) algorithms used to find a minimum spanning tree for a weighted undirected graph. (4 mark)

ii. Write a pseudo-code for one (01) of the algorithms mentioned in part b(i). (6 mark)

c. Starting from node A, traverse through the graph in Figure 1 using the following algorithms (State the steps clearly).

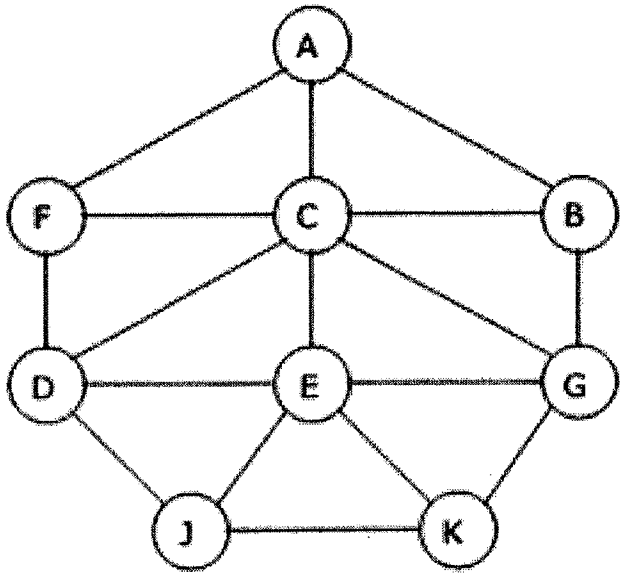

Figure 1 : Graph

i. Depth-first traversal (DFT)

ii. Breadth-first traversal (BFT)

(12 mark)