THE UNIVERSITY OF TRINIDAD AND TOBAGO

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FINAL ASSESSMENT/EXAMINATIONS APRIL/MAY 2014

Course Code and Title: Algorithm Analysis and Design DSAL3001

Programme: B.A.Sc. ICT Engineering

Date and Time: **Duration:** 3 hours

PLEASE READ ALL INSTRUCTIONS CAREFULLY BEFORE YOU BEGIN THIS EXAMINATION

Instructions to Candidates

1. **This paper has _4_ pages and _7_questions.**
2. **You are required to answer all questions.**
3. **The question paper must be returned with the script.**

Key Examination Protocol

1. Students please note that academic dishonesty (or cheating) includes but is not limited to plagiarism, collusion, falsification, replication, taking unauthorised notes or devices into an examination, obtaining an unauthorised copy of the examination paper, communicating or trying to communicate with another candidate during the examination, and being a party to impersonation in relation to an examination.
2. The above mentioned and any other actions which compromise the integrity of the academic evaluation process will be fully investigated and addressed in accordance with UTT's academic regulations.
3. Please be reminded that speaking without the Invigilator's permission is **NOT** allowed.

1. Given the following list of numbers:

15	30	16	18	14	10	22	46	28	21

Show the step by step configuration of the list as a Merge Sort algorithm is applied to the list. [5]

2. T(n) is the running time of the algorithm on an input size n, Given that

$T(1) = 1$
$T(n) = 2\,T(n + 2) + 2n + c$, for $n > 1$ and a constant c

Derive the formula for T(n) and determine the order of the algorithm, state any assumptions made. [5]

3. Given the following Algorithm, determine its asymptotic order:

Let k be some positive integer [5]

```
n = 2^K
count = 0
 while n >= 1
        for j = 1 to n
                count  = count + n
        end for
        n  = n/4
 end while
return count
```

4. Two strings X and Y of lengths n and m, respectively, over an alphabet Z such that

X = “Rover is an energetic dog.”
Y = “The car is on the verge of dying.”

Write Java code to output the length of the longest common subsequence of X and Y using Dynamic Programming. [10]

5. In a new fun game for a family day, a field is divided into m rows and n columns of blocks. Starting from the top row, a player must move to a block to the bottom collecting 'points' as he goes. At each step a player can moved diagonally to either of the following:

    a. The block to his left in the next row provided he is not already at the extreme left.
    b. The block to his right in the next row provided he is not already at the extreme right.

    Each block has a point value assigned to it, p where 0<=p<=10.
    When a player moves to a block, he must add its point value to his score.
    Assume that the rows of the blocks are numbered 1 to m, going from the top to the bottom and columns are numbered 1 to n, from left to right. T[i,j] contains the point value of the block in the i^{th} row and j^{th} column.

    Write Java code which uses an efficient algorithm to determine the maximum score a player can get as he moves from any block in the top row to a block in the bottom row. [10]

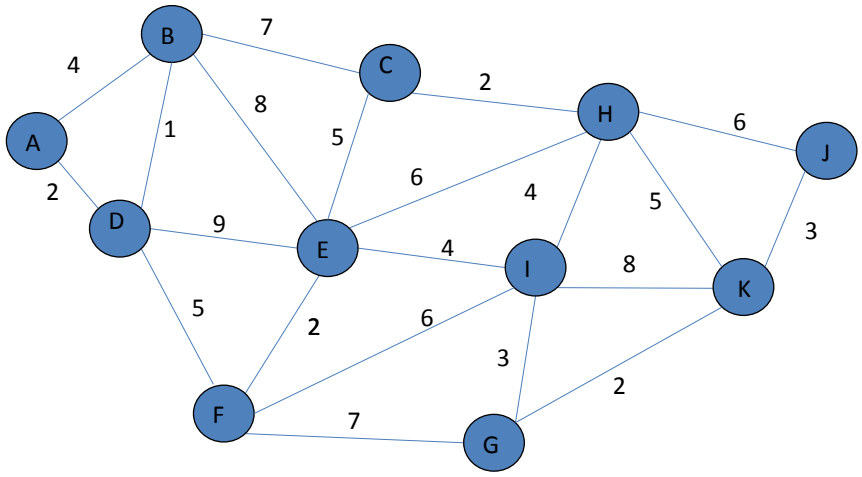
6. A Truck is used to transport industrial items of different weights. Each item has a specific weight and value labeled as shown below:

Item	Weight	Value
1	1	15
2	5	10
3	3	9
4	4	5

    The maximum weight that can be accommodated is 8.

    Write a Java program that uses the dynamic programming to solve this problem. [10]

7. The diagram below shows an undirected acyclic graph.



a. Using Dijkstra's algorithm, compute the shortest path to all other nodes starting from node 1. [7]

Clearly show the state of the minimum priority queue, the distance and parent nodes for each pass of the algorithm. [8]

b. Write Java code that outputs the shortest part from node 1 to every other node using the information in part (a).

c. Given the adjacency matrix of another graph below, show the derivation of a topological sort. Clearly show the parent nodes, queue, and state during construction [10]

A	B	C	
B	A	D	G
C	B	D	
D	E	F	G
E	C		
F	E		
G			