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: Monday, April 28, 2014 **1:00 p.m. – 4:00 p.m.** **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 Quick 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

$T(1) = 1$
$T(n) = 2\,T(n/2) + c$, 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 + 1
        end for
        n  = n/2
 end while
return count
```

4. The *n*-queens problem is to place *n* queens on an *n*-by-*n* chessboard so that no two queens attack each other by being in the same row or in the same column or on the same diagonal. Write a Java code that uses the backtracking strategy to solve the 5-queens problem. [10]

5. You are given a checkered board T(m,n) as the follows:

7	6	3	5	4
3	4	7	2	7
2	9	4	3	6
6	5	2	0	8
5	6	5	1	3

Write Java code to determine efficiently the path used to compute the highest score moving from top to bottom using the following criteria

- You cannot move directly into the cell below
- You can move into two possible cells in the row below (diagonally left or diagonally right) [10]

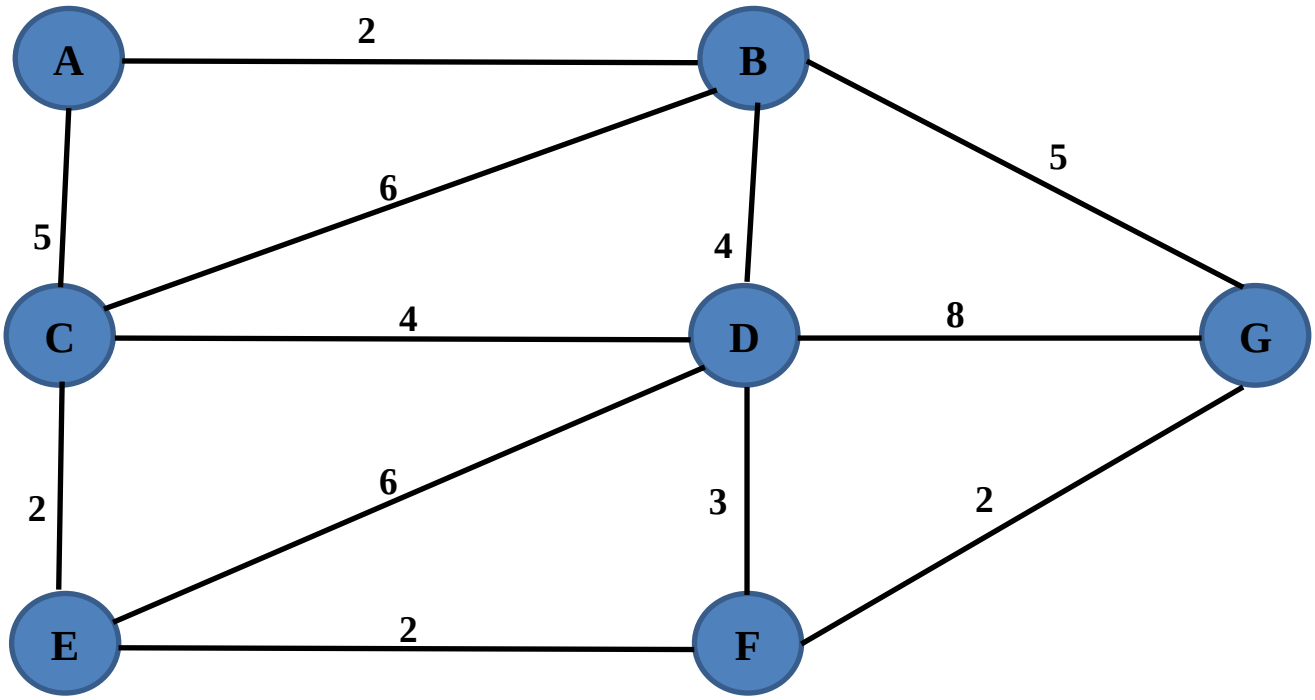
6. The notorious thief **Black Jack** has broken into a famous jewellery store in Chaguanas. The thief has plans to make a single grab and exit before the security guards arrive blocking his escape. He wishes to pack his bag with jewelry that will return the most profit when he delivers his loot. The weights and values of each item is shown below:

Item	Weight (kg)	Value (millions)
1	6	6
2	5	4
3	4	3
4	2	5
5	1	9

The maximum weight that can be accommodated is 10.

a. Write a Java method to compute a table H[i,j] which tracks the highest value of items that can be placed in the bag.
b. Construct the table H[i,j] using the data provided in the table above. [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 A. [8]

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

b. Write Java code that outputs the shortest part from node A to every other node using the information in part (a). [7]

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			