BITS, Pilani – Dubai, Academic City, Dubai.

III Year FIRST SEMESTER 2008-2009

Degree: B.E. (Hons.) Branch: C.S.

TEST I Question Paper

Course No : CS C341 Course Title: Data Structures and Algorithms

Date: 12, October, 2008 Sunday Time: 50 min. Total marks: 20

Data provided are complete. **Closed** ***Book***.

This question paper has one page.

Answer all Questions.

1. Write the algorithm for computing the **depth** of a node **v** in a tree T. [2 M]

2. The following character string is to be transmitted using HUFFMAN CODING:

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a) Construct the HUFFMAN Coding Tree for the letters present in the above string and *determine* the number of bits required to code each letter. [4 M]
b) Find the expected (average) number of bits per letter. [1 M]

3. **Construct** a binary tree corresponding to the following expression:

$[a+(b-c)]*[(d-e)/(f+g-h)]$

Show the PRE-ORDER and POST-ORDER Traversal of the above Binary Tree. [3 M]

4. a) Trace through (algorithm not to be written) the successive passes of MERGESORT for the following input data:

66, 33, 40, 22, 55, 98, 60, 11, 80, 20, 50, 44, 77, 30, 107, 308, 207, 408, 300, 200. [3.5 M]

b) Analyze the worst-case time complexity of MERGESORT. [1.5 M]

5. Write the Algorithm for the Fractional Knapsack Problem, using the greedy method. [3 M]

6. Consider the following TASK SCHEDULING problem using Greedy method, whose collection of pairs of start times and finish times is given below:
{ (1,3), (1,4), (2,5), (3,7), (4,6), (6,8), (7,10) }

Solve the above problem (show in the form of a diagram). [2 M]

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QUIZ III

Course No : CS C341 Course Title: Data Structures and Algorithms
Date: 30, Nov., 2008 Sunday Time: 15 min. Total marks: =5
Weightage: 5% Venue : 335 ***Closed Book.***
This question paper has 2 pages [use ***back page*** for ***rough work*** only]

IDNO: **Name:**

Write answers in the space provided in question paper. Answer all questions.

1. Briefly explain the ZIG-ZAG operation in a SPLAY TREE. 2 M

2. What is the time complexity (using BIG O notation) for the following operations in a SKIP LIST ? 1 M

insertItem:

removeElement:

findElement:

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TEST II Question Paper

Course No : CS C341 Course Title: Data Structures and Algorithms

Date: 23, November, 2008 Sunday Time: 50 min. Total marks: 20

Data provided are complete. **OPEN *Book*.**

Text / Reference Book and student's hand written class notes permitted.

This question paper has 2 pages.

Answer all Questions.

1. Show (trace through) the Successive steps of HEAPSORT for sorting the elements in ascending order for the array given below:

A = [27, 10, 16, 12, 33, 22, 44] (5 marks)

2. Consider the following sequence of keys:

{ 2, 1, 4, 5, 9, 3, 6, 7 }

Show all the steps in the INSERTION of above items with this set of keys, in the *order given*, into an **initially empty AVL tree.** (4 marks)

3. Consider the Adjacency Matrix for a directed graph G shown below:

	A	B	C	D	E	F	G	H
A	0	1	0	1	1	0	0	0
B	0	0	0	1	0	0	0	0
C	0	0	0	0	1	0	0	1
D	0	0	0	0	0	1	1	1
E	0	0	0	0	0	0	1	0
F	0	0	0	0	0	0	0	0
G	0	0	0	0	0	0	0	0
H	0	0	0	0	0	0	0	0

a) Draw the Graph G. [1 Mark]

b) Using DFS (show all steps), find all nodes that are reachable from node A and Print them.

[3 marks]

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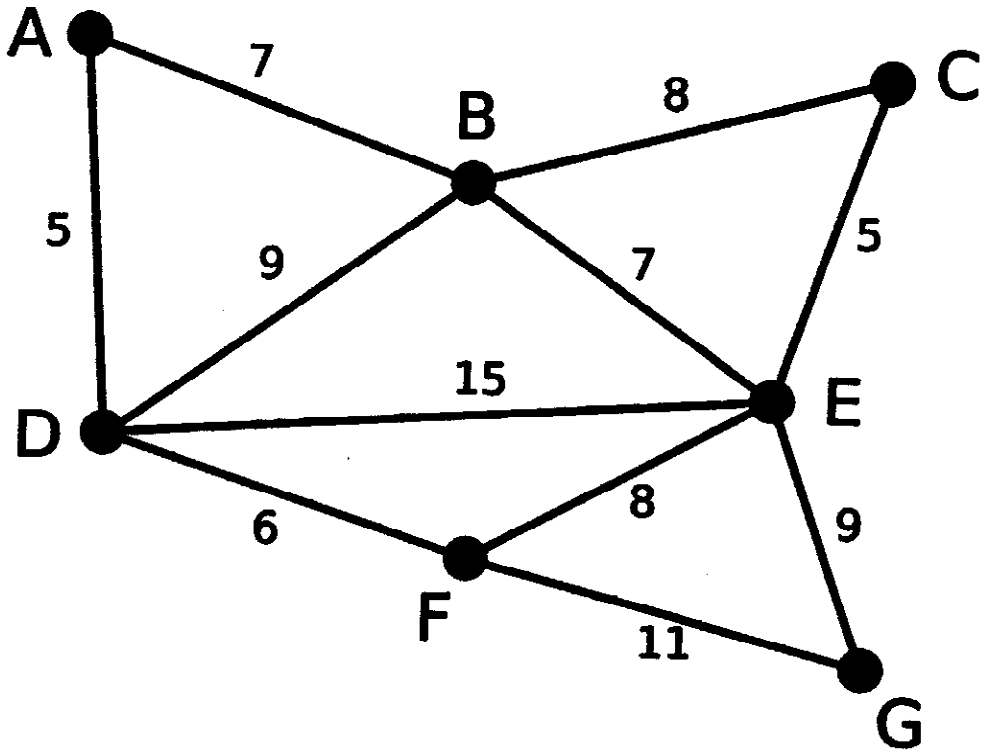
4. Consider the following sequence of keys:
{ 5, 22, 45, 16, 2, 10, 18, 30, 50, 1, 12 }

a) Show all the steps in the INSERTION of above items with this set of keys, in the *order given*, into an **initially empty (2,4) tree** . (i.e. 2-3-4 tree) (3 marks)

b) Delete the item with the **key 18,** in the tree created in the previous step (4 a.) and draw the resulting tree (i.e. the tree after the delete operation is performed). (1 mark)

5. Construct the Minimum Spanning Tree for the weighted graph shown below using PRIM's Algorithm. (3 marks)



BITS, Pilani – Dubai, Academic City, Dubai.
III Year First Semester 2008-2009
Degree: B.E. Hons. Branch: C.S.
QUIZ II
Course No : CS C341 Course Title: Data Structures and Algorithms
Date: 29, Oct., 2008 Wednesday Time: 15 min. Total marks: =5
Weightage: 5% Venue : 335 ***Closed Book***.
This question paper has 2 pages [use ***back page*** for ***rough work*** only]
IDNO: **Name:**

Write answers in the space provided in question paper. Answer all questions.

1. It is required to insert the following five strings in a HASH Table of size 6 (assume *separate chaining* for handling collisions):

EAR **LUY** **BSA** **PHI** **TOZ**

The hash function is defined as follows:

"*Add* the **ASCII values** of individual letters in a *given input string* [ASCII value of 'A' is 65, 'B' is 66 and so on] and find the **sum**.

Hash Value = (5+ **sum**) % 6
[% means modulus, meaning remainder after division]". This hash value will be the position (in hash table) at which the input string will be inserted.

Now Insert all the above five input strings at appropriate positions in the Hash Table. (you have to show the hash table here) [2.5 M]

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IDNO: **Name:**

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2. Binary Search Tree (ordered binary tree)

a) **Insert** items with the following keys (in the given order, read from left to right) into an initially empty *binary search tree* and show the final tree, only.
53,47,63,50,45,58,68,55,49,59,71,65,44,46,52 [1 mark]

b) **Delete** the items with **keys 47** and **65** in the tree obtained in previous step (i.e. 2 a) and display the new tree, only (after completion of delete operation). [1.5 mark]

a)

b)

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Degree: B.E.(Hons.) Branch: C.S.

Comprehensive Examination Question Paper

Course No : CS C341 Course Title: Data Structures and Algorithms

Date: 07, Jan., 2009 Wednesday Time: 10 a.m.- 1 Noon Total marks: 80

Weightage: 40% Data provided are complete. ***Closed Book.***

Answer **all** Questions. This question paper has **2** pages.

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1) What are the *average-case* and *worst-case* time complexities for MERGESORT and HEAPSORT ? [2M]

2) What is a POLYNOMIAL HASH CODE ? [2 M]

3) State formally the TASK SCHEDULING problem w.r.t. Greedy Method. [2 M]

4) What is *Character-Jump Heuristic* w.r.t. Boyer-Moore Algorithm in pattern matching involving strings ? [2 M]

5) State the properties of a *Standard Trie.* [2 M]

6) *Write* an **Algorithm** for the HANGMAN problem stated as follows:

Two players A and B proceed to play the word guessing game HANGMAN. Player A thinks of an English Word [assume that the length of the word does not exceed 20 characters]. Now, Player B proceeds to guess the word thought over by Player A by typing one letter at a time. The *number of chances* given to player B is equal to number of *unique letters* present in the word plus three. Initialize *the number of errors* to zero at the beginning.

If Player B guesses a letter correctly, it is displayed at all position(s) within the word as appropriate and decrement the *number of chances* by 1. If the Player B guesses a letter wrongly, then display an error message, decrement the *number of chances* by 1 and increment the *number of errors* by 1. If the Player B guesses an already chosen letter (chosen earlier in previous attempts), display the message "you already guessed that" and the counts for *chances* and *errors* remain unchanged. The games ends when the player B guesses the word in the given number of chances or when the player B is unable to guess the word. In either case, *display* appropriate message, display the correct word and show the counts for *chances* and *errors*. [5 marks]

7. Briefly, define the following methods w.r.t. a generalized Sequence ADT:

a) atRank(r) b) rankof (p) c) elemAtRank(r)
d) after(p) e) insertFirst(e) [5 M]

P.T.O.

8. Write the ALGORITHM(s) to perform the following operations on a QUEUE ADT using array-based implementation: (assume circular array)

a) *enqueue(o)* b) *dequeue()*

[5 M]

9. Write the ALGORITHM(s) to perform the following operations on a TREE ADT (general tree) :

a) Compute the height of the sub-tree of tree T rooted at node **v** .
b) Pre-order Traversal of a Tree T.
c) Post-order Traversal of a Tree T. (2+1.5+1.5 M)

10.Write an algorithm to compute ALL-PAIRS SHORTEST PATH DISTANCES (Floyd-Warshall Algorithm) using Dynamic Programming design technique. [6 M]

11. Consider the following sequence of keys:

{ 10, 30, 20, 200, 40, 190, 50, 180, 70, 160, 120, 60, 150, 100, 90 }

Show all the steps in the INSERTION of above items with this set of keys, in the *order given*, into an **initially empty AVL tree.** [5 M]

12. Explain the Insertion Algorithm for SKIP LISTS with an example. [5 M]

13. Which Design Technique will you choose to solve the SUM of SUBSETS problem ? Illustrate with an example. [6 M]

14. **Solve** the given NP-COMPLETE problem TSP using the **SHORTEST-LINK** strategy. The problem is stated as follows:

A traveling salesperson (TSP) has to visit eight cities (A,B,C,D,E,F,G,H) and return to the starting city. Assume that he/she starts his tour from city **D**. He/she must visit every city and should visit it only once (he ends his tour by returning back to starting city). The cost of travel (i.e. distance) from city **i** to city **j** is given. Find out the optimal tour. (i.e. the tour involving minimum cost of travel (i.e. distance)). Assume undirected graph representation.

DE = 6	CD=8	BC=6	CE= 10	GH=4	AB=12	BE=13
DH=3	EF=4	FG=13	AE=5	AF=3	CG=3	

[8 M]

15. Trace through the successive steps for inserting the following keys, in the given order, into an initially empty **B-Tree** of degree 3. (i.e. t=3; an internal node can have between 2 to 5 keys):

37, 09, 29, 58, 16, 10, 07, 27, 17, 61, 14, 51, 24, 41, 34, 31, 44, 21, 54, 11

[10 M]

16. Solve the following instance of LCS (longest common subsequence) problem:

X = { B, C, D, C, E, B, C }
Y = { C, E, D, B, C, B } [10 M]

(show the successive steps in a table only ; algorithm not required)