Exam Date: 13/07/2023

CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY
B.Sc. ENGINEERING LEVEL-2 TERM-I (20 Batch) EXAMINATION '2022

DEPARTMENT : ELECTRONICS AND TELECOMMUNICATION ENGINEERING
FULL TITLE OF PAPER : Data Structures and Algorithms
COURSE NO. : CSE 281
FULL MARKS : 210
TIME : 3 HOURS

The figures in the right margin indicate full marks. Answer any THREE questions from each section. Use separate script for each section.

Section-A

Q.1(a) Define data structure. List different operation performed on data structure. **10**

(b) Why do you need data structure? How can you choose an appropriate data structure? **10**

(c) What is an Algorithm? Write down the characteristics of an algorithm. **08**

(d) Write down the limitations of C structures. **07**

Q.2(a) How can you access data of a class from outside the scope? Mention some differences between a normal function and a member function. **10**

(b) What are limitations of arrays? How you can insert a node into a singly linked list- Explain. **15**

(c) Convert the following arithmetic infix expression into its equivalent postfix expression: **10**

A-B/C+D*E+F

Q.3 (a) Evaluate each of the following parenthesis-free arithmetic expressions: **14**

i. $5, 3, +, 2, *, 6, 9, 7, -, /, -$

ii. $3, 1, +, 2, \uparrow, 7, 4, -, 2, *, +, 5, -$

(b) Draw a schematic diagram of the recursive solution to the "Tower of Hanoi" problems for n=3 disks. **12**

(c) Draw the binary search tree that results from inserting the following numbers in sequence starting with **09**

11:11,47,81,9,61,10,12

Q.4 (a) A binary tree has 10 nodes. The inorder and preorder traversals of the tree yield the following sequences of nodes: **10**

Inorder:	8	4	10	9	11	2	5	1	6	3	7
Preorder:	1	2	4	8	9	10	11	5	3	6	7

Draw the tree.

(b) Write down the properties of an AVL tree. Insert the following values in order shown to construct an AVL search tree **64, 90, 96, 88, 108, 65, 36, 37, 95, 90, 82.** **13**

(c) Insert the following keys into an initially empty B-tree of order 5: **12**

$$a, g, f, b, k, d, h, m, j, e, s, i, r, x, c, l, n, t, u, p$$

What will be the resultant B-Tree after deleting key ***j***, ***t*** and ***d*** in sequence?

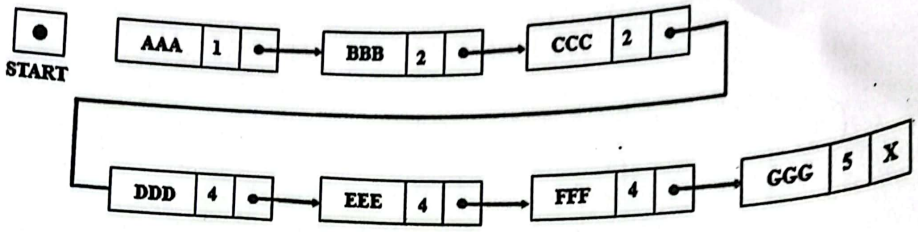

Fig. 5(a)

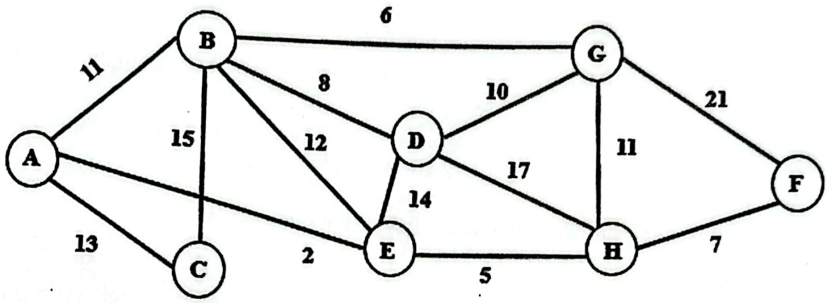

Fig. 7(c)

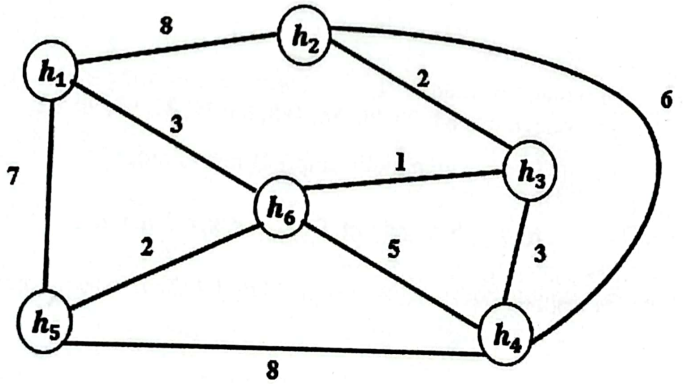

Fig. 8(b)

Section-B

Q.5 (a) Consider the priority Queue shown in Fig 5(a): **12**

i. Show the one-way list representation of it

ii. Show the structure after (MMM, 2) ; (NNN, 3) ; (ZZZ, 2) ; and (WWW, 1) are added to the queue.

(b) What do you mean by heap? Sort following values into ascending order using heap sort algorithm: **13**

$$16, 4, 7, 1, 13, 17$$

(c) Write a C program to reverse a string using stack. **10**

Q.6 (a) The keys **12,17,13,25,43,5** and **15** are inserted into an initially empty hash table of length 15 using open addressing with hash function h(k)=k mod 10 and linear probing. What is the resultant hash table? **15**

(b) Explain different ways of representing a graph in memory. **10**

(c) Sort the following element using radix sort: **10**

$$15, 1, 321, 10, 802, 2, 123, 90, 109, 12$$

Q.7 (a) What is greedy algorithm? Consider the following instance of the knapsack problem $n = 4, M = 23, (P_1, P_2, P_3, P_4) = (10,5,5,15)$ and $(W_1, W_2, W_3, W_4) = (20,5,15,5)$. Find an optimal solution using Fractional Knapsack. **10**

(b) Design a method for keeping two stack within a single linear array so that neither stack overflow until all the memory is used. **10**

(c) Write down the properties of MST. Compute a MST for the graph of Fig. 7(c) using an appropriate algorithm. **15**

Q.8 (a) Consider the following 4-digit employee numbers: **9614, 5882, 6713, 4409, 1825.** Find the 2 digit hash address of each number using: **15**

i) The division method m=97

ii) The mid square method

iii) The folding method.

(b) Write the Floyd Warshall algorithm to compare the all pair shortest path. Apply the algorithm on following graph in Fig. 8(b). **20**

THE END

Exam Date: 06/09/2022

CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY
B.Sc. ENGINEERING LEVEL-2 TERM-I(19 Batch) EXAMINATION '2021

DEPARTMENT : ELECTRONICS AND TELECOMMUNICATION ENGINEERING
FULL TITLE OF PAPER : Data Structures and Algorithms
COURSE NO. : CSE 281
FULL MARKS : 210
TIME : 3 HOURS

The figures in the right margin indicate full marks. Answer any THREE questions from each section. Use separate script for each section.

Section-A

Q.1(a) Define data structure. Why we need data structure? **06**

Q.1(b) Describe the classification of data structures with proper diagram. **09**

Q.1(c) Write down the steps studying the data structure. How to choose an appropriate data structure? **08**

Q.1(d) What are the limitations of array? Differentiate between array and linked lists. Mention applications of different linked lists. **12**

Q.2(a) Mention the operations on stack. Write down the procedure for **10**

(i) Insert ITEM into a queue
(ii) pop an ITEM from a stack

Q.2(b) Write down the properties of recursive function. Suppose you are give an array which contains the path information of a route. Now you have to write a recursive function that will take a destination node and print the path from destination to source. The path array is given in Table 2(b). The recursion will stop when the node value become -1. Sample output for destination 5 will be 5 4 1. recursion will stop when the node value become -1. Sample output for destination 5 will be 5 4 1.

Path	-1	1	4	1	4	2	
0	1	2	3	4	5	6	7

Table 2(b)

Q.2(c) Convert the following expression into post fix expression using stack and show that details of stack at each step of conversion. **13**
Expression: $((A + B)/D) \uparrow (E - F) * G)$

Q.3(a) Write only the C++ function that can find the parent and depth of the tree nodes. And illustrate recursive steps on that function for the following tree shown in Fig. 3(a). Consider you have two global variable parent and depth. **12**

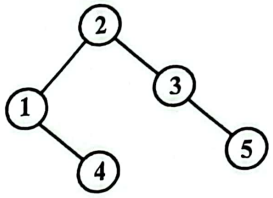

Fig. 3(a)

Q.3(b) Consider the following data items: **13**
1,20,-2,8,14,10,9,16,2,7,9

(i) construct a binary search tree
(ii) compute the number of comparisons needed to construct the tree.

Q.3(c) Define a full binary tree and complete binary tree. Which one is better BST or AVL tree? **10**

Q.4(a) Write only the C++ functions for finding the binary tree (shown in Fig. 4(a)) traversal. Consider you have two global variables, left and right. Show the recursion steps. **18**

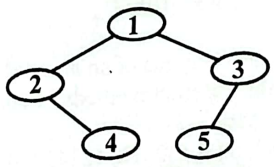

Fig. 4(a)

Q.4(b) Construct a B-tree of order of 5 with the following set of data: **17**
D, H, Z, X, K, B, P, Q, E, A, S, W, T, C, N, L, M, Y

Section-B

Q.5(a) Write down the pros and cons of BFS and DFS. Consider the graph G in Fig.5(a). Suppos represents the daily flights between cities of some airline, and suppose we want to fly city A to c H with the minimum number of stops. Now find the minimum path P from A to H using Breadt First search algorithm.

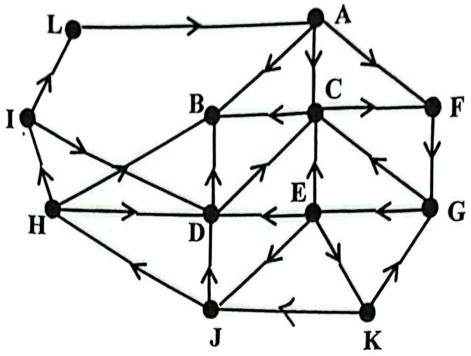

Fig. 5(a)

Q.5(b) Write down the algorithm for binary search. Also compute its complexity. **10**

Q.5(c) Briefly explain AVL search tree. Insert the following values in the order shown to construct on AVL search tree. **10**

5,10,15,20,25,30,35

Q.6(a) Write short notes on **08**

(i) Divide and conquer

(ii) Greedy method

Q.6(b) Write down the properties of minimum spanning tree. Find the minimum cost spanning tree for the graph in Fig. 6(b) using Krushkal's algorithm. **12**

Q.6(c) Write down the selection sort algorithm. Suppose $T(n)$ denotes the running time of merge sort. Give the recurrence equation for $T(n)$ and solve it for finding the complexity of merge sort. **15**

Q.7(a) Apply Warshall's algorithm to find the shortest path between every pair of vertices in the graph shown in Fig. 7(a). **12**

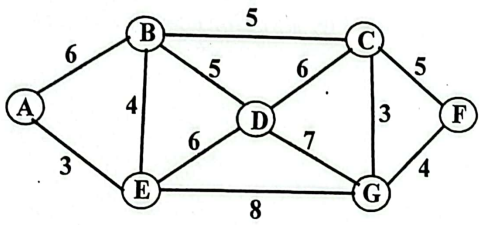

Fig. 6(b)

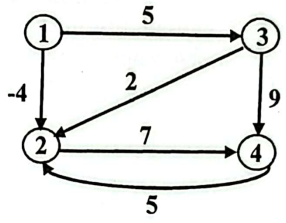

Fig. 7(a)

Q.7(b) Shahida is going to return back Bangladesh after visiting from Canada. In her flight, she will be allowed to carry a small luggage called carry on of capacity 9 kg which she will be allowed to keep with herself inside the plane. While packing she wants to take the most valuable things from the following items in the carry on. Now your tusk is to help her selecting the most valuable items. You have to list the items need to be taken (shown in Table 7(b).). **13**

Item	Camera	Book	Cosmetics	Decoration piece	Food	Cloths
Weight (kg)	2	1	3	2	3	2
Price	45	15	20	20	15	30

Table 7(b)

Q.7(c) Write a C++ program to find the duplicate elements of an array. (Use visited array and vector). **10**

Q.8(a) Explain the concept of Hashing. Describe different methods of resolving collisions. **12**

Q.8(b) Sort the following elements using radix sort. **11**

5, 1, 43, 548, 132, 78, 1234, 290

Q.8(c) Consider the 4-digit employee numbers: **12**

9624, 5892, 6714, 4509

Find the 2-digit hash address of each number using

(i) The division method with m=97

(ii) The mid-square method

(iii) The folding method reversing

THE END

G

n Fig.5(a). Suppose
t to fly city A to ci
H using Breadth

CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY
B.Sc ENGINEERING LEVEL-II TERM-I EXAMINATION '2020

DEPARTMENT : ELECTRONICS AND TELECOMMUNICATION ENGINEERING
FULL TITLE OF PAPER : Data Structures and Algorithm
COURSE NO. : CSE 281
FULL MARKS : 150
TIME : 2 HOURS

The figures in the right margin indicate full marks. Answer any TWO questions from each section. Use separate script for each section.

Section-A

Q.1(a) Define recursive problem. Draw the schematic diagram of the recursive solution to Tower of Hanoi problem for n=3 disks. 10

(b) Consider the following expression 12

$$A + (B * C + (D + E - F) * \left(\frac{G}{H}\right) * I - K)$$

Transform the infix notation into equivalent postfix expression. Show the stack position at each step. 15.5

(c) Write a C++ code to add and multiply two numbers using class and objects.

Q.2(a) What is the "Tower of Hanoi" problem? Draw a schematic diagram of the recursive solution to the "Tower of Hanoi" problems for n=4 disks. 17.5

(b) A binary tree T has 9 nodes. The inorder and preorder traversals of T yield the following sequences of nodes: 10
inorder: E A C K F H D B G
Preorder: F A E K C D H G B
Draw the tree T.

(c) Briefly describe the garbase collection technique. Also explain the overflow and the underflow situation. 10

Q.3(a) Construct a balance binary search tree by inserting the following elements in the order of their occurrence into an empty tree- 15.5
14,17,11,7,53,4,13,12,8,60,19,16,20
Show the final tree after deleting the node 11.

(b) What do you mean by class and objects? What are the limitations of C structure? How does class of C++ overcome these limitations? 12

(c) What is the complexity of BFS and DFS algorithm? Consider the graph G in Fig.3(c). Suppose represents the daily flights between cities of some airline and suppose we want to fly from city A to city J with the minimum number of stops. Now find the minimum path P from A to J using Breadth-First search algorithm. 10

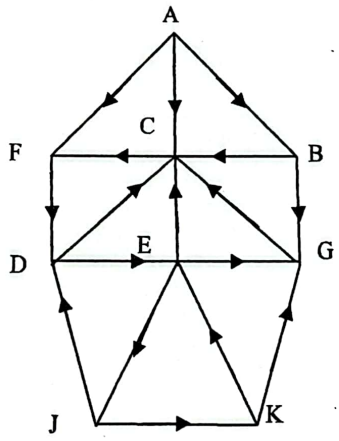

Fig.3(c)

14.5

Section-B

Q.4(a) Find an optimal solution to the knapsacle instance n=7; m=15; (p1, p2, ... p7) = (10,5,15,7,6,18,3) and (W1,W2,.....W7)=(2,3,5,7,1,4,1) 13

(b) Describe prime's algorithm with appropriate diagram. Also write the pseudocode of prime algorithm and show complexity. 10

(c) State Gready-Choice properties. Prove that the functional Knapsack problem has the greedy choice properties. 15

Q.5(a) Write down the algorithm for quick sort. Also compute its average case and worst case complexity. 12.5

(b) Find out the minimum cost spanning tree of the graph depicted in Fig.5(b) using prim's algorithm.

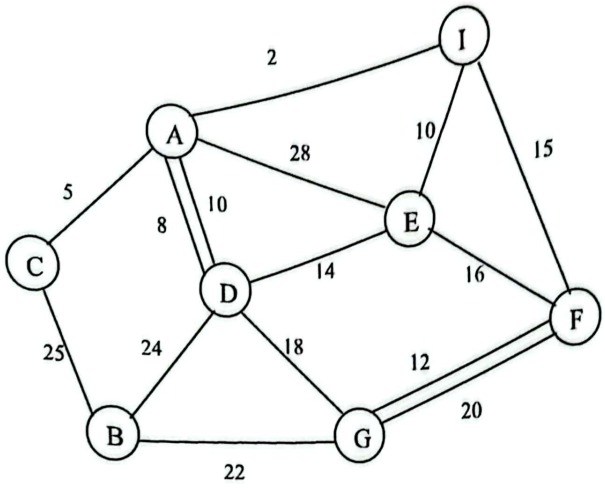

Fig. 5(b)

(c) Write short notes on: 10
- i) Hashing and
- ii) Collision resolution

Q.6(a) Describe the basic principle of dynamic programming with the help of an example. 10

(b) What do you mean by L(S) with the algorithm to find the length of LCS. Also deduce the complexity. 12

(c) Draw the Fibonacci tree of fib(5) with and without using dynamic programming. 05

(d) Let the Hash table has 13 electro element array and K is the key of a data record. H(K)=K mod 13. Insert the keys 83,94,14,29,70,21,65,72,36,56,84.25,46. For solving the collision use linear probing. 10.5

THE END

CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY
B.Sc. ENGINEERING LEVEL-2 TERM-I EXAMINATION '2019

DEPARTMENT : ELECTRONICS AND TELECOMMUNICATION ENGINEERING
FULL TITLE OF PAPER : Data Structures and Algorithms
COURSE NO. : CSE 281
FULL MARKS : 210
TIME : 3 HOURS

The figures in the right margin indicate full marks. Answer any THREE questions from each section. Use separate script for each section.

Section-A

Q.1(a) Define Data Structure. Explain types of Data Structure with example. 10

(b) What are the steps in studying Data Structure? How can you choose an appropriate data structure? 10

(c) Explain the concept of divide and conquer, greedy approach of algorithm design strategy with appropriate example. 15

Q.2(a) Compute the time complexity of the following code segments: 10

i)
```
int sum1=0;
for (k=1; k≤n; k*=2)
    for(j=1; j≤n; j++ )
        sum1++;
```

ii)
```
int fun(int n) {
int count=0;
for (i=n; i>0; i/=2)
    for(j=0; j<i; j++ )
      count+=1;
return count;}
```

(b) Differentiate between (i) Arrays and linked lists, (ii) overflow and underflow situations. 08

(c) Write down the algorithms for the following tasks: 6*2+5=17

i) To pop and push an element from/in a stack when the stack is implemented using array.
ii) To insert an element in a queue
iii) To convert an infix expression to a postfix one.

Q.3(a) Write an algorithm/program with input CITY A and CITY B which finds the way to fly from the city A to city B with a minimum number of stops. 10

(b) Construct an AVL search tree by inserting the following elements in the order of their occurrence into an empty tree. 12

64, 1, 44, 26, 13, 110, 98, 85, 77, 79.

Show the final tree after deleting 98, 64, and 79.

(c) Insert the following keys in the order shown below into an initially empty m-way search tree of order. (i) 5, (ii) 4, (iii) 3 13

G, S, F, L, Q, X, Z, V, R, A, I, J, W

Q.4(a) What is a binary tree? Find the preorder, inorder and post order traversals of the following binary tree of Fig. 4(a). 10

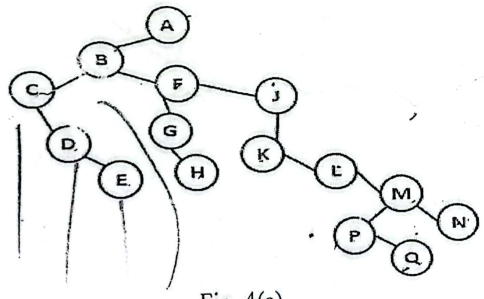

Fig. 4(a)

(b) Construct heap tree and B-tree by inserting the following keys:
4, 5, 10, 20, 1, 6, 3, 29, 30
Let, both heap tree and B-tree are initially empty.

(c) Differentiate BFS and DFS with its pros and cons.

Section-B

Q.5(a) Define Big oh, Omega and Theta notation. What do you mean by O(1)?

(b) Compute the no. of steps and complexity of the following segments:

i)
```
Algorithm Fibonacci(n)
{
  if (n≤1) then
     write (n);
  else
  {
     fnm2:=0; fnm1:=1;
     for i:=2 to n do
     {
       fn:=fnm1+fnm2;
       fnm2:=fnm1; fnm1:=fn;
     }
      write (fn);
  }
}
```

ii)
```
for (k=1; k<=n; k=k*2)
    for(j=1; j<=n; j++ )
      sum++
```

(c) Define algorithm. What are the basic criteria's that all algorithms must follow. – Explain briefly with example. 11

Q.6(a) Given a knapsack having maximum weight capacity, w=4, and the number of items available are three such that 12

$s=3$, number of items
$w_i = < 1, 3, 4 >$, weights
$v_i = < 3, 4, 5 >$, profits

Fill the knapsack such that the knapsack should not exceed its maximum capacity and it should have maximum profit.

(b) What is spanning tree and minimum cost spanning tree? Using an appropriate algorithm find out the minimum cost spanning tree of the graph given below. 13

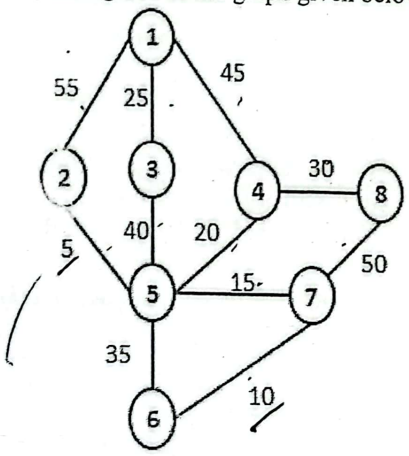

Fig. 6(b)

(c) Apply Warshall's algorithm to find the shortest path between every pair of vertices in the graph given below. 10

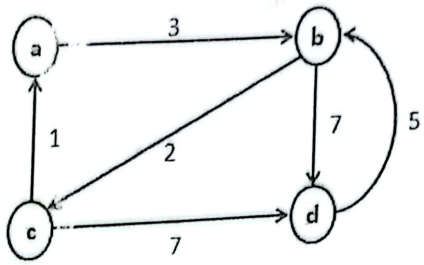

Fig. 6(c)

Q.7(a) Differentiate between dynamic programming and divide & conquer. 05

(b) What is Longest Common Subsequence (LCS) problem? Write the recurrence equation of LCS and use it to find the length and LCS for the two input strings: X=abcba, Y=bdcb. 15

(c) Given the adjacency matrix A of an undirected graph G. 05

$$A = \begin{pmatrix} 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 \end{pmatrix}$$

Draw the graph G.

(d) Explain the concepts of Longest Common Subsequence (LCS) problem. Also, explain a dynamic programming approach to find LCS. 10

Q.8(a) Write short notes on: i) Hashing and ii) Collision Resolution 10

(b) Sort the following elements using Radix sort:

435, 548, 132, 788, 1234, 290. 15

(c) Consider the following 4-digit employee numbers:

9614, 5882, 6713, 4409, 1825.

Find the 2 digit hash address of each number using

i) the division method with m=97
ii) the mid square method
iii) the folding method without reversing

The End

CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY
B.Sc ENGINEERING LEVEL-II TERM-I EXAMINATION '2018

DEPARTMENT : ELECTRONICS AND TELECOMMUNICATION ENGINEERING
FULL TITLE OF PAPER : Data Structures and Algorithms
COURSE NO. : CSE 281
FULL MARKS : 210
TIME : 3 HOURS

The figures in the right margin indicate full marks. Answer any THREE questions from each section. Use separate script for each section.

Section-A

Q.1(a) Define data structure. Write five different types of operations that can be performed in a data structure. 08

(b) What is the importance of data structure? How can you choose an appropriate data structure? 08

(c) Write a C++ code to add and multiply two numbers using Class and Objects. 10

(d) Briefly explain memory representation techniques of two dimensional arrays. 09

Q.2(a) Define Stack and Queue. Write a procedure to
i) Insert an item in a queue.
ii) Delete an item from a Queue. 10

(b) Consider the following arithmetic expression
$$A * (B + D) / E - F*(G + H / K)$$
Transform the infix notation into equivalent postfix expression. Show the stack position at each step. 12

(c) What is the tower of " Tower of Hanoi" problem? Draw a schematic diagram of the recursive solution to the "Tower of Hanoi" problems for n=4 disks. 13

Q.3(a) Consider the following data items:
10, -1, 8, 12, 10, 14, 16, 2, 4, 4
i) Construct a binary search tree with above data.
ii) Compute the number of comparisons needed to construct the binary search tree using above data. 13

(b) Define Binary tree, 2 –tree, complete Binary tree, Binary search tree. Write down the ways of traversing in Binary tree. 10

(c) Consider the priority queue as shown in Fig. 3(c) 12

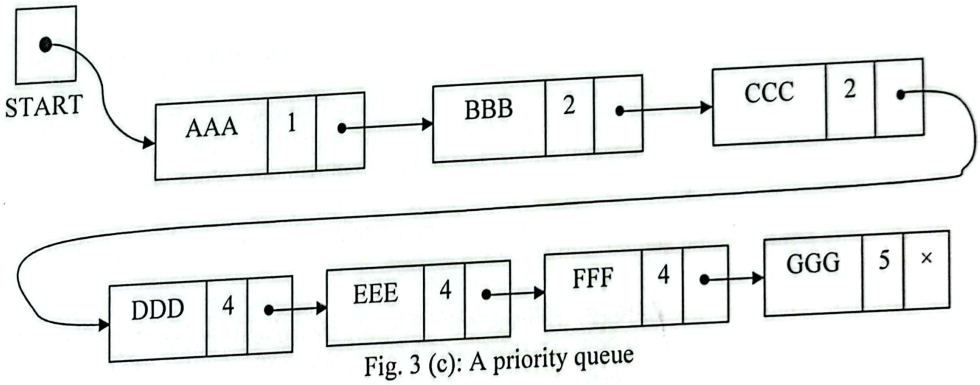

Fig. 3 (c): A priority queue

i) Show the one-way list representation of it.
ii) Show the structure after (XXX, 2); (YYY, 3), (ZZZ, 2) and (WWW, 1) are added to the queue.

Q.4(a) Construct a B-tree of 3 (2-3 tree) by inserting the following keys in the order shown into an empty B-tree: 15
3, 7, 9, 23, 45, 1, 5, 14, 25, 24, 13
Show the final tree after deleting the keys 5 & 7.

(b) Explain the relative advantages and disadvantages of BFS and DFS. Consider the graph shown in Fig. 4(b), from a source node A to a destination node G. Show each step of the traversal using Depth first search.

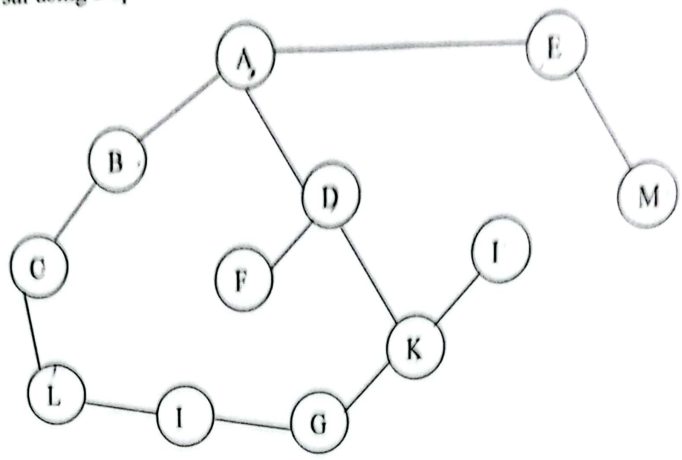

Fig. 4(b)

(c) Explain adjacency, incidence and list representation of a graph. 08

Section-B

Q.5(a) Define Big 'oh', Omega and Theta notations. What do you mean by O(1)? 10

(b) i) Compute the complexity of the following code segment: 14

```
sum=0;
  for(k=1; k<=n; k*=2)
      for(j=1; j<=k; j++)
sum=sum++;
```

ii) Suppose you are the system architect of a software development team and you need a particular problem solved. Faisal and Shuvo are two software engineers are working in your team and each of them has written a correct solution for the problem. Faisal's solution runs in O(M^3*N) while Shuvo's solution runs in O(N^2*M) for input sizes of M & N. Which of the two solutions do you think will run faster? Explain.

(c) Write down the algorithm for binary search. Also, compute it's complexity. 11

Q.6 (a) Write down the algorithm for quick short. Also, compute it's average case complexity. 18

(b) Write down the control abstraction and recurrence relations for divide and conquer strategy. 10

(c) Differentiate between greedy method and dynamic programming. 07

Q.7(a) State greedy choice property. Prove that, the fractional knapsack problem has the greedy choice property. 10

(b) Suppose you have a knapsack of capacity 100. There are five objects, whose values are V_1=20, V_2=30, V_3= 66, V_4= 40, V_5=60 and the weights W_1=10, W_2=20, W_3=30, W_4=40 and W_5 =50 respectively. Select the objects so that the maximum values will be gained using 0/1 knapsack algorithm. 13

(c) Explain the concept of Longest Common Subsequence problem (LCS). Also, explain a dynamic programming approach to find LCS. 12

Q.8 (a) Draw the Fibonacci tree of fib(5) with and without using dynamic programming. 06

(b) Give a comparison among P, NP, NP-hard and NP-complete. 10

(c) Let the hash table be an II electron element array and k is the key of a data record. H(k) represents the hash function where H(k)=kmod II. Insert the keys 83, 14, 29, 70,10,55,72. 36,65, 48. For resolving collision use linear probing 13

(d) Write short notes on: 06

i) Minimum spanning tree.

ii) Double Hashing.

THE END

CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY
B.Sc ENGINEERING LEVEL-II TERM-I EXAMINATION '2017

DEPARTMENT : ELECTRONICS AND TELECOMMUNICATION ENGINEERING
FULL TITLE OF PAPER : Data Structures and Algorithms
COURSE NO. : CSE 281
FULL MARKS : 210
TIME : 3 HOURS

The figures in the right margin indicate full marks. Answer any THREE questions from each section. Use separate script for each section.

Section-A

Q.1(a) What do you mean by data structure? Describe the classification of data structures with proper diagram. 11

(b) What do you mean by class & objects? What are the limitations of C structures? How does class of C++ overcome those limitations? 15

(c) Differentiate : 9
(i) Stack & queue
(ii) Pointer arrays & records
(iii) Array & link list

Q.2(a) What is recursive procedure? Write a recursive procedure to calculate the Greatest Common Division (GCD) of two numbers. Which data structure is used to perform recursion? 10

(b) Convert the given infix expression to postfix expression using stack and show the details of stack at each step of conversion. 15

Expression :

(4 + 8) * (6-5)/((3-2)*(2+2))

(c) Suppose $p(n) = a_0 + a_1 n + a_2 n^2 + \ldots\ldots\ldots + a_m n^m$ 10

that is , suppose degree $p(n) = m$. Prove that $p(n) = o(n^m)$.

Q.3(a) For the following Binary tree in Fig. 3(a), Write the order of nodes visited (a) In - order Traversal (b) Pre -order Traversal (c) Post- order Traversal. 10

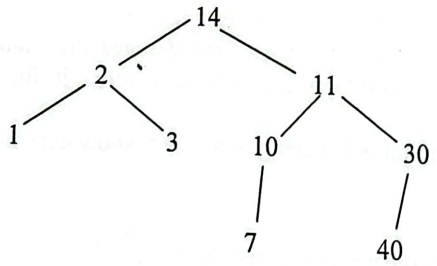

Fig. 3(a)

(b) For the tree shown in Fig.3(a) , answer the following questions: 10
i) Form a binary search tree (BST) and represent this in an array .
ii) Add a node with the data value 15 and redraw the BST.
iii) Delete the node having the data value 30 from the BST and redraw the BST.

(c) What is a binary search tree ? Construct a binary search tree with the help following data items: 10
20, -10, 8, -12, 15, 25, 88, 62, 45, 13, 8, 70, -10
Also compute the number of comparisons needed to construct the binary search tree with above data items.

(d) Distinguish among private, public and protected members of a class. 5

Q. 4(a) Explain the concepts of garbage collection .Write an algorithm to insert an element at the beginning of a linked list. 12

(b) Explain three different ways of representing a graphin memory. 15

(c) What is a path matrix? Use Warshall's algorithm to compute path matrix from the following graph [Fig. 4(c)].

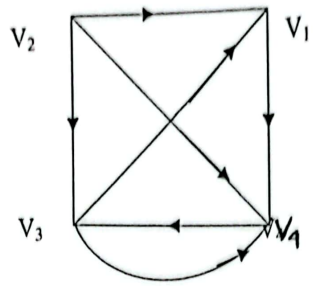

Fig.4(c)

Section-B

Q.5(a) Define Big 'oh', Omega and Theta notations. What do you mean by O(1)? 10

(b) What do you mean by time space trade off ? Compute the time complexity of the following code segments: 14

i.
```
for(j=1; j<=n; j++)
    for(k=1; k<=n; k+=2)
    printf ("it is not complex");
```

ii.
```
sum=0;
  for(j=1; j<=n; j++)
      for(i=1; i<=j; i++)
count=count +2;
for(k=0; k<n; k++)
A[K]=K;
```

(c) You are given an array of N integers ? Find the an algorithm to reverse the array. 8

(d) What is the complexity of your algorithm in 5(c)? 3

Q.6 (a) When will both binary & linear search yield same complexity? 7

(b) Write down the merge sort Algorithm. Suppose T(n) denotes the running time of merge sort. Give the recurrence equation for T(n) and solve it for finding the complexity of merge sort . 15

(c) Sort the following array in ascending order using quick sort .show each necessary step. 10

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

(d) Do you think merge-sort would have performed better in 6(c). 3

Q. 7(a) What is meant by hashing? Explain three different methods for collision resolution during the implementation of hash function. 12

(b) Maliha is going to return back Bangladesh after visiting from USA. In her flight she will be allowed to carry a small luggage called carry on of capacity 7 kg which she will be allowed to keep with herself inside the plane. While packing she wants to take the most valuable things from the following items in the carry on. Now your task is to help her selecting the most valuable items. You have to list the items need to be taken. 13

Item	camera	Book	Cosmetics	Decoration piece	Chocolate	Handy cam
Weight(kg)	2	1	3	1	2	2
Price	45	15	20	10	10	30

(c) Define minimum spanning tree with proper diagram. Compute a minimum cost spanning tree for the graph in Fig. 7(c) using Kruskal's algorithm . 10

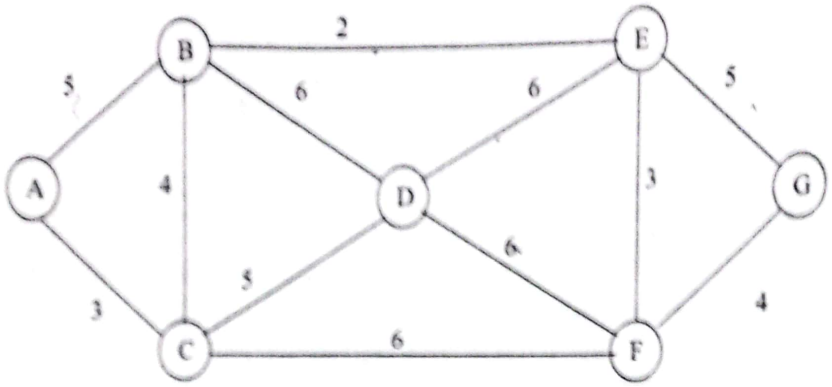

Fig. 7(c)

Q. 8(a) Distinguish between greedy method and dynamic programming. 06

(b) Draw the Fibonacci tree of fib(5) with and without using dynamic programming. 10

(c) Suppose you want to measure the similarity between pair of words. Now find similarity between the two words- 12

1) Genes

2) Jeans

(d) Write down the concepts of skip-lists. 07

THE END

CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY
B.Sc ENGINEERING LEVEL-II TERM-I EXAMINATION '2016

DEPARTMENT : ELECTRONICS AND TELECOMMUNICATION ENGINEERING
FULL TITLE OF PAPER : Data Structures and Algorithms
COURSE NO. : CSE281
FULL MARKS : 210
TIME : 3 HOURS

The figures in the right margin indicate full marks. Answer any THREE questions from each section. Use separate script for each section.

Section-A

Q.1(a) What do you mean by data structure? Write down the steps in the study of Data dtructure? How to choose an appropriate data structure? 06

(b) Describe the clssifications of Data structure with proper diagram. 09

(c) What do you mean by class and object? What are the limitations of C structures? How does class of C++ overcome those limitations? 10

(d) Write a C++ code to add and multiply two numbers using class and objects. 10

Q.2(a) Define Stack and Queue. Write a procedure to -------
i) Insert an item in a queue.
ii) Delete an item from a Queue. 10

(b) Translate each of the following infix expression into its equivalent postfix expression. 12

i) (A+B↑D)/ ((E-F)+G*H
ii) (A-B)*(D/E)

(c) What is the tower of " Tower of Hanoi" problem? Draw a schematic diagram of the recursive solution to the "Tower of Hanoi" problems for n=4 disks. 13

Q.3(a) Define Binary tree, 2 –tree, complete Binary tree, Binary search tree. Write down the ways of traversing in Binary tree. 09

(b) Briefly explain AVL search tree. Insert the following values in the order shown to construct an AVL search tree 64, 90, 96, 85, 110, 65, 36, 37, 95, 93,91 13

(c) Contruct a B-tree of 3(2-3 tree) by inserting the following keys in the order shown into an empty B-tree: 13

M Q A N P W X T G E T

After construction, delete W, G, A

Q.4(a) Draw a binary tree and explain the following terminologies 10
i) Parent
ii) Child
iii) Breach
iv) Generation
v) Depth
vi) Decendent
vii) Siblings

(b) Briefly describe the garbadge collection technique. Also explain the overflow and the underflow situation. 10

(c) Explain the relative advantages and disadvantages of BFS and DFS. Consider the graph shown in Fig. 4(c), from a source node A to a destination node I, show each step of the traversal using BFS. 15

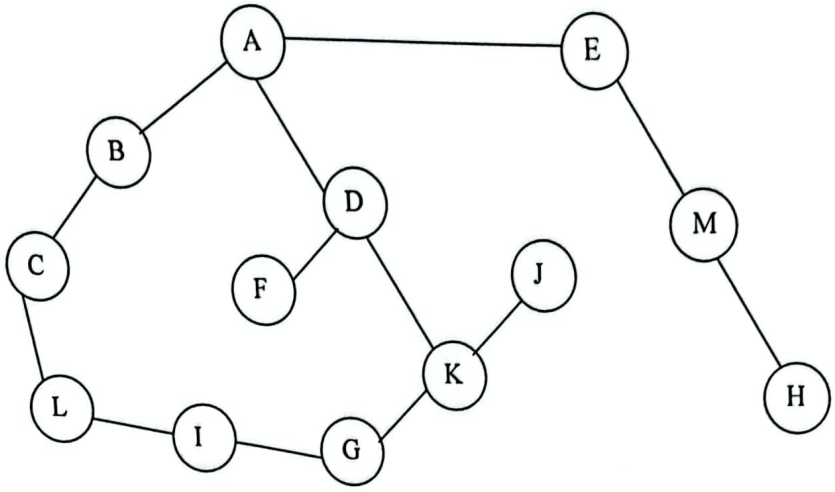

Fig. 4(c)

Section-B

Q.5(a) Define Big oh, Omega & Theta notation. 09

(b) What is an algorithm? What are the criterias that algorithms must satisfy- describe. 10

(c) What do you mean by time & space complexity? Compute the time complexity of the following algorithm: 16 12

i)

```
1   Algorithm Add (a, b, c, m, n)
2   {
3     For i : = 1 to m do
4     {
5         count : = count +2;
6         for j: =1 to n do

7        count: = count +2
8     }
9     count: =count+1 ;
10  }
```

ii)

```
1     Sum1=0;
2     for ( k=1; k<=n; k*=2)
3        for (j=1; j<=n ; j++)
4           sum1++
5     Sum2 = 0 ;
6     for ( k=1; k<=n; k*=2)
7        for (j=1; j<=k ; j++)
8           sum2++ ;
```

Q.6 (a) Explain the concept of Hashing. Describe different methods of resolving collisions. 18

(b) What is a R-B tree? Write down the properties of R-B tree. 07

(c) Find the longest common subsequence (LCS) for X=abcba, Y=bacdba. 10

Q.7(a) Differentiate between divide and conquer approach and dynamic programming. List some optimization problems which use dynamic programming method for solution. 07

(b) Describe the partitaioning procedure in quick sort algorithm. Sort the following values using quick sort algorithm: 15

65, 75, 70, 80, 85, 55. 60, 50, 45

(c) Suppose you have a Kaapsack of capacity 100. There are five objects whose values are V_1=20, V_2=30, V_3=66, V_4=40, V_5=60 and the weights W_1=10, W_2=20, W_3=30, W_4=40 and W_5=50 respectively. Select the objects so that the maximum values will be gained using O/I Kaapsack algorithm. 13

8(a) Apply merge sort algoriths to sort the following data items: 12
8, 6, 20, 15, 19, 40, 6, 2, 1, 50, 23. You must have to show the merging procedure. What is the height of the merge sort tree?

(b) Write down the Prim's algorithm to find the minimum cost spanning tree. 11

(c) Consider the following 4-digit employee numbers: 12

3205, 5882, 2345, 1825

Find the 2-digit hash address of each number using (i) the division method with m=97; (ii) the mid square method; (iii) the folding method without reversing and (iv) the folding method with reversing,

The End

CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY
B.Sc ENGINEERING LEVEL-II SELF STUDY EXAMINATION '2016

DEPARTMENT : ELECTRONICS AND TELECOMMUNICATION ENGINEERING
FULL TITLE OF PAPER : Data Structures and Algorithms
COURSE NO. : CSE281
FULL MARKS : 210
TIME : 3 HOURS

The figures in the right margin indicate full marks. Answer any THREE questions from each section. Use separate script for each section.

Section-A

Q.1(a)	Define Data Structure. Write five different types of operations that can be performed in a data structure.	08
(b)	Write down the relative advantage and disadvantage of Breadth First Search (BFS) and Depth First Search (DFS).	07
(c)	What is a member function? Where will you define a member function List the characteristics of the member function.	10
(d)	Defne Data hiding. How does a class accomplish data hiding?	06
Q.2(a)	Define a recursive procedure. Draw the schematic diagram of the recursive solution to Tower of Hanoi problem for n=3 disks.	13
(b)	Consider the following arithmetic expression A*(B+D) / E-F*(G+H/K) Transform the infix notation into equivalent postfix expression. Show the stack position at each step.	12
(c)	What is a priority queue? What is the minimum number of queues needed to implement the priority queue?	05
(d)	Mention some major differences between stack and queue.	05
Q.3(a)	Briefly describe different binary tree traversal techniques.	09
(b)	A binary tree T has 9 nodes. The inorder and preorder traversals of yield the following sequences of nodes: Inorder : E A C K F H D B G Preorder : F A E K C D H G B Draw the tree T.	10
(c)	Explain the search technique of Binary search tree.	08
(d)	Distinguish between i) Binary tree and complete Binary tree ii) Ancestors and Descendants of a node	08
Q.4(a)	Write an algorithm that finds the location of an TEM of information in the binary search tree (BST), T or insert ITEM as a new node. Construct a BST from the given values. Consider the first value as the root value. 65, 45, 23, 49, 52, 11, 7, 23, 85, 92	13
4(b)	From a source node A to a destination node G, show each step of the traversal using breadth first search (BFS) in Fig 4(b).	12

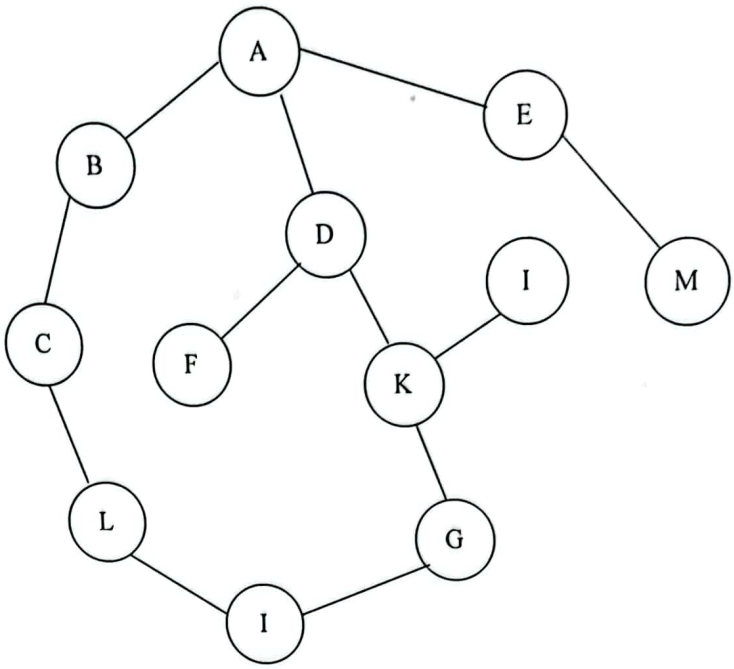

Fig. 4(b)

(c) Describe Prim's algorithm with appropriate diagram. Also write the pseudocode of prim's algorithm and show complexity. 10

Section-B

Q.5(a) What are the important criteria of an algorithm? Explain the best case, average case and worst case analysis of running time of the algorithms. 10

(b) Define Big 'Oh', Omega and Theta notations. Show that the following equalities are correct: 12

(i) $5n^2 - 6n = \theta(n^2)$
(ii) $6*2^n + n^2 = 0(2^n)$
(iii) $100n + 6 = \Omega(n)$

(c) Compute the time complexity of the following code segment: 06

```
sum 2=0;
for (k=1; k ≤ n; k*=2)
    for (j=1 ; j ≤ k ; j++)
        sum2 ++ ;
```

(d) Briefly describe the notions of 07

i) the complexity of an algorithm
ii) the space-time trade off of the algorithm

Q.6 (a) Suppose the following numbers are sorted in an array A: 10

32, 51, 27, 85, 66, 23, 13, 57

Apply Bubble sort algorithm to sort the array and discuss each part separately.

(b) Apply merge sort algorithm to sort the following data items: 15

310, 285, 179, 652, 351, 423, 861, 254, 450, 520.

(c) Compare Quick sort and Merge sort algorithm in terms of time complexity? Which one is better? Justify your answer. 10

Q.7(a) Consider the following instance of the knapsack problem: n=3, m=20, (P_1, P_2, P_3)= 10

(25, 24, 15) and (w_1,w_2,w_3) = (18, 15,10). Find an optimal solution using an O/I knapsack algorithm.

(b) Write down the properties of a minimum cost spanning tree (MST). Describe the kruskal's algorithm for finding MST of a graph. 13

(c) Apply Dijkstra's algorithm to find the shortest path from the source S to all other vertices in the following graph of Fig. 7(c).

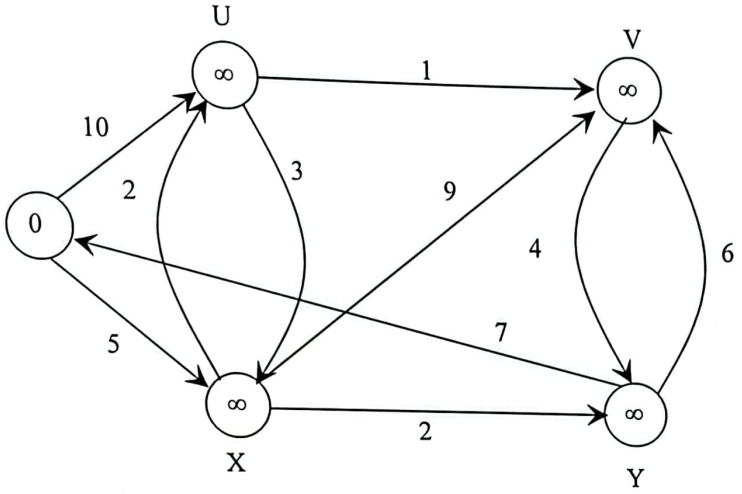

Fig. 7(c)

Q.8(a) Describe the basic principle of dynamic programming with the help of an example. 10

(b) What do you mean by LCS? Write the algorithm to find the length of LCS. Also deduce the complexity. 13

(c) Let the Rash table is an 11 electron element array and k is the key of a data record. H(k) =k mod 11. Insert the keys 83, 14, 29, 70, 20, 55, 72, 36, 56, 84, For solving the collision use linear probing. 10

THE END

CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY
B.Sc ENGINEERING LEVEL-II TERM-I EXAMINATION '2015

DEPARTMENT	: ELECTRONICS AND TELECOMMUNICATION ENGINEERING
FULL TITLE OF PAPER	: Data Structures and Algorithms
COURSE NO.	: CSE281
FULL MARKS	: 210
TIME	: 3 HOURS

The figures in the right margin indicate full marks. Answer any THREE questions from each section. Use separate script for each section.

Section-A

Q.1(a) What do you mean by data structure? What is the importance of it? How can you choose an appropriate data structure? 08

(b) Give a brief description of different types of operations that can be performed on a data structure. 09

(c) What do you mean by class and object? How can you create an object of a class? Briefly discuss on how the memory space is allocated for the objects with proper diagram. 12

(d) Describe the mechanism of accessing data members and member functions inside the main program. 06

Q.2(a) Define stack. Mention the operations on stack. Write down the procedure that – 10

i) PUSH an ITEM onto a stack.
ii) POP an ITEM from a stack.

(b) Write down the applications of stack in computer science. Write an algorithm that finds the VALUE of an arithmetic expression P written in postfix notation. Evaluate the following expression P using the above mentioned algorithm: 15

P: 3, 5, +, 6, 4, -, *, 4, 1, -, 2, ↑, +

(c) Define a recursive function. Write a recursive function to calculate the GCD of two numbers. 10

Q.3(a) What is the "Towers of Hanoi" problem? Draw the schematic diagram of the recursive solution to the Towers of Hanoi problem for N=4 disks. 13

(b) Briefly explain binary search tree. Create a binary search tree with data item: 14, 10, 17, 12, 10, 11, 20, 12, 18, 25, 20, 8, 22, 11, 23 consider the first value as root value. Also determine the total number of comparison needed to create the binary search tree with above data item. 12

(c) Consider the priority queue as shown in Fig.3(c) 10

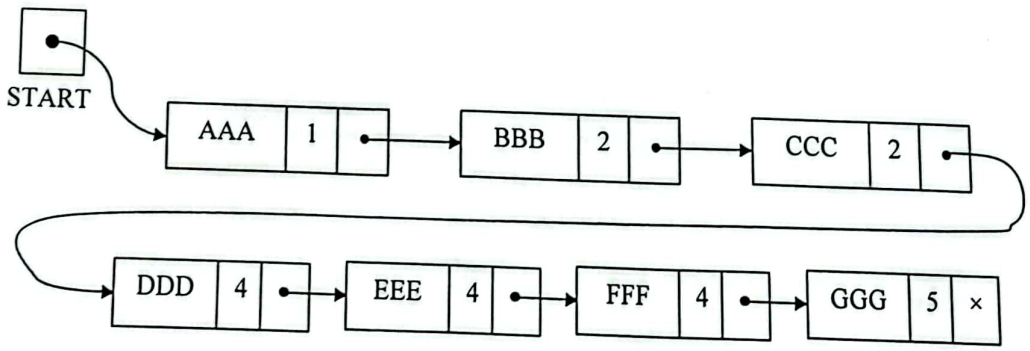

Fig.3(c): A priority queue

i) Show the one-way list representation of it.
ii) Show the structure after (XXX,2); (YYY, 3), (ZZZ, 2) and (WWW, 1) are added to the queue.

Q.4(a) Write down the procedure for Breadth-First Search (BFS) and Depth-First Search (DFS) to traverse a graph. Implementβ FS and DFS to the following graph starting from node A [Fig.4(a)]. 18

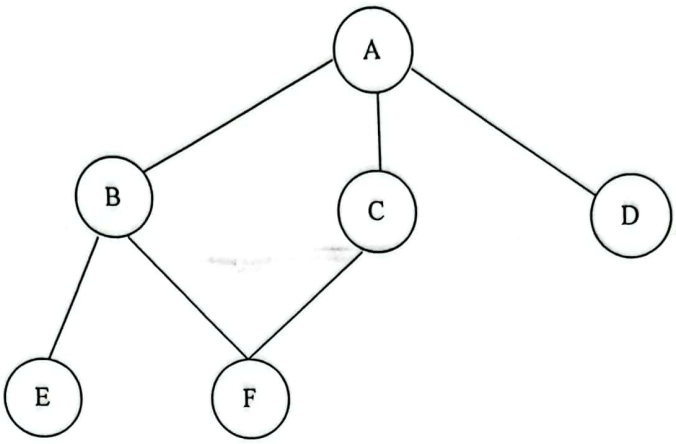

Fig.4(a)

(b) Contrast binary search tree (BST) with sorted linear array and linked list. Write an algorithm that finds the location of an ITEM of information in the BST T, or inserts ITEM as a new node. 10

(c) Define Queue. And also describe three real life applications of a queue. 07

Section-B

Q.5(a) What is an algorithm? Write down the important criteria of an algorithm. 08

(b) What is time-space trade-off? Compute the time complexity of the following code segments: 15

i.
```
Algorithm Fibonacci (n)
    {
      if (n≤1) then
          write (n);
      else
      {
       fnm2=0; fnm1=1;
       for (i=2 to n) do
       { fn=fnm1+ fnm2 ;
         Fnm2 =fnm1; fnm1=fn;
       }
       write (fn) ;
       }
    }
```

ii.
```
sum=0;
for ( j=1 ; j <=n; j++)
    for (i=1 ; i<=j; i++)
        sum ++ ;
for (k=0; k<n; k++)
    A[k]=k;
```

(c) Briefly discuss the best case, average case and worst case analysis of running time of the algorithms with their relative advantages and disadvantages. 12

(a) Write down the Merge sort algorithm. Suppose T(n) denotes the running time of merge sort. Give the recurrence equation for T(n) and solve it for finding the complexity of merge sort. 15

(b) Define dynamic programming? Write down the steps of designing a dynamic programming algorithm. List some optimization problems which use dynamic programming method for solution. 10

(c) Sort the following values using quick sort algorithm: 10

65, 70, 75, 80, 85, 95, 55, 50, 45, 65

Q.7(a) State greedy-choice property. Prove that the fractional Knapsack problem has the greedy-choice property. 10

(b) Define minimum spanning tree with proper diagram. Compute a minimum cost spanning tree for the graph of Fig.7(b) using kruskals algorithm. Here the root vertex is A. 15

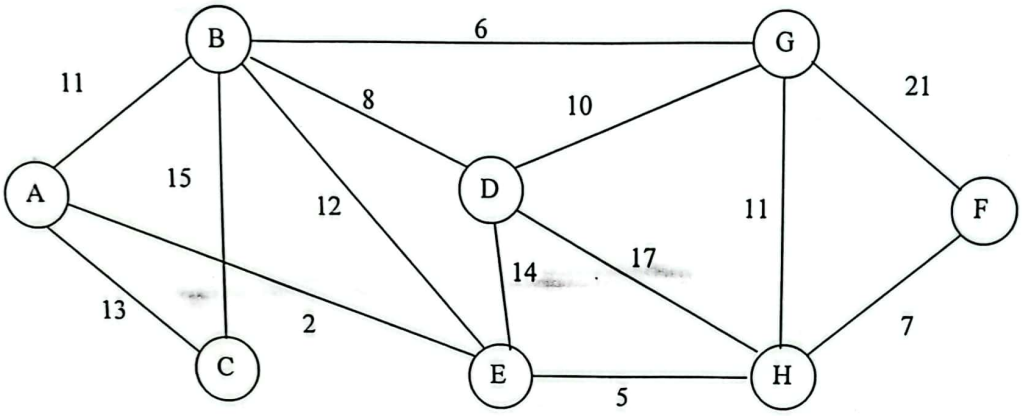

Fig. 7(b)

(c) What is hashing? Explain three different mechanisms for collision resolution in hashing. 10

Q.8(a) Consider the graph G in Fig. 8(a). Suppose G represents the daily flights between cities of some airline, and suppose we want to fly from city A to city J with the minimum number of stops. Now find the minimum path P from A to J using Breadth –First search algorithm. 13

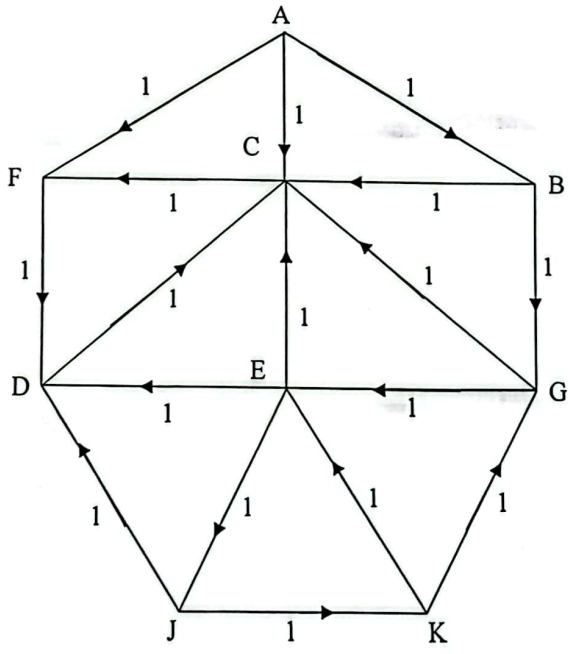

Fig.8(a)

(b) Describe Diskstra's algorithm of finding the shortest path from a single source to all other vertices in a graph. Show its time complexity. 12

(c) Consider the following 4-digit employee numbers: 10

9614, 5882, 6713, 4409, 1825

Find the 2-digit hash address of each number using i) the division method with m=97; (ii) the mid square method; iii) the folding method without reversing.

THE END

CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY
B.Sc ENGINEERING LEVEL-II TERM-I EXAMINATION '2014

DEPARTMENT	: ELECTRONICS AND TELECOMMUNICATION ENGINEERING
FULL TITLE OF PAPER	: Data Structures and Algorithms
COURSE NO.	: CSE281
FULL MARKS	: 210
TIME	: 3 HOURS

The figures in the right margin indicate full marks. Answer any THREE questions from each section. Use separate script for each section.

Section-A

Q.1(a) What do you mean by data structure? Write down the steps that are followed in the study of data structures. How can you choose an appropriate data structure? 10

(b) Describe the classification of data structures with a proper diagram. What is abstract Data Type (ADT)? 09

(c) What are the limitations of structure used in C? How does class of C++ overcome those limitations? 10

(d) How does a class accomplish data Riding? 06

Q.2(a) Explain the purposes of the visibility labels (Private, Public and Protected) used in C++ class. 10

(b) What is recursive procedure? Write a recursive procedure to calculate the Greatest Common Division (GCD) of two numbers. Which data structure is used to perform recursion? 10

(c) Convert the given infix expression to postfix expression using stack and show the details of stack at each step of conversion. 15

Expression :

(a + b * c ^ d) * (e + f/g)

Here, ^ indicates exponent operator.

Q.3(a) What is Binary tree? Construct a Binary search tree from the given values. Consider the first value as the root value. 13

45, 23, 29, 85, 92, 7, 11, 35, 49, 52

(b) From a source node A to a destination node G. Show each step of the traversal using Depth first search. Fig 3(b). 12

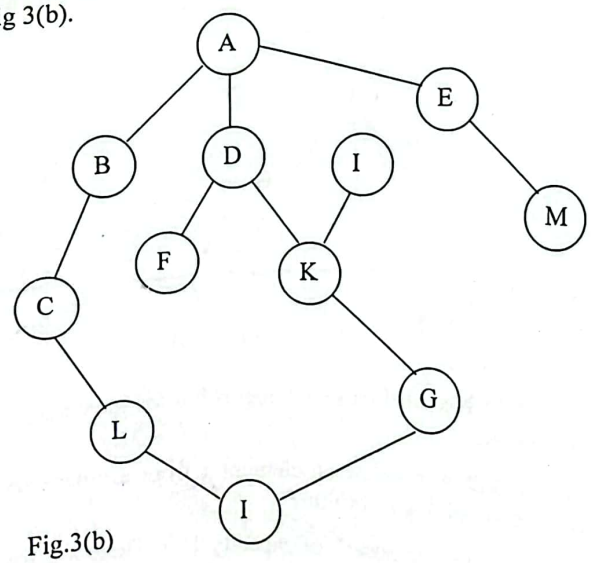

Fig.3(b)

(c) Briefly explain the concept of priority queue with suitable example. 10

Q.4(a) Suppose the following list of letters is inserted in order into an empty binary search tree: 15

J, R, D, G, T, E, M, H, P, A, F, Q

Show all stages to build the final tree T.

(b) What is the height of the merge sort tree? Suppose T(n) denotes the running time of merge sort. Give the recurrence equation for T(n) and solve it for finding the complexity of merge sort. 15

(c) Briefly explain two applications of queue. 05

Section-B

Q.5(a) Define Big 'on' ; Omega and Theta notations. What do you mean by O(1)? 10

(b) What do you mean by time and space complexity? Complete the time complexity of the following algorithm: 10

```
i. Algorithm sum (a,n)
ii. {
iii. for i :=1 to n do count:= count +2;
iv. count:= count +3 ;
v. }
```

(c) What is the difference between stack and queue? What do you mean by deque? How can you represent a deque in computer? 10

(d) What is the difference between divide & conquer approach and dynamic programming? 05

Q.6 (a) State greedy choice property. Consider the knapsack instance n=3, $(w_1, w_2, w_3) = (2,3,4)$, $(P_1, P_2, P_3)= (1,2,5)$ and m=6. Using 0/1 knapsack algorithm finds an optimal solution. 12

(b) What is meant by minimum cost spanning tree? Apply Premis algorithm to find minimum spanning tree of the following graph. The root vertex is A. 15

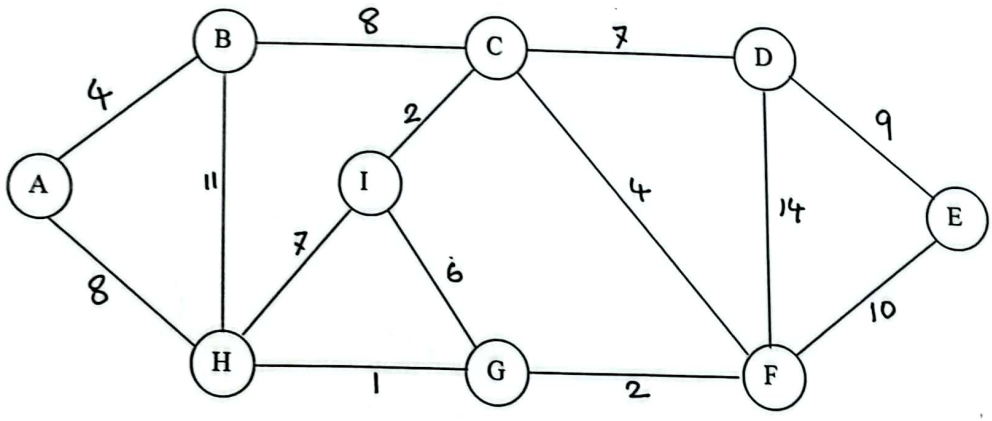

Fig. 6(b)

(c) Write down the breadth-first search algorithm for traversing a graph G beginning at a starting node A. 08

Q.7(a) Write an algorithm to delete an element *x* from a binary search tree *t*. What is the time complexity of this algorithm? 15

(b) Suppose you have a knapsack of capacity 100. There are five objects, whose values 15

are V_1=20, V_2=30, V_3= 66, V_4= 40, V_5=60 and the weights W_1=10, W_2=20, W_3=30, W_4=40 and W_5=50 respectively.
Select the objects so that the maximum values will be gained using 0/1 knapsack algorithm.

(c) Write down the pros and cons of BFS and DFS algorithm. 05

Q.8(a) What is dynamic programming? Write down the steps of designing a dynamic programming algorithm. 07

(b) Let the hash table be an II electron element array and k is the key of a data record. H(k) represents the hash function where H(k)=kmod II. Insert the keys 83, 14, 29, 70,10,55,72. 36,65, 48. For resolving collision use linear probing. 13

(c) Write short notes on 15

i) Double Hashing.
ii) Load Factor.
iii) Uniform Hasing.

THE END