Hajee Mohammad Danesh Science & Technology University, Dinajpur.
B. Sc in TEE
Semester Final Examination 2014 (Jan-June)
Level 2   Semester I
Course Code: CIT 219 Credits: 03
Course Title: Data Structure & Algorithms (Theoretical)
Time: 03 hours   Full Marks: 90

Section-A
Answer Any Three

1. a) What is data structure? List out the areas in which data structures are applied extensively.   3
    b) What is the difference between linear and nonlinear data structures?   3
    c) What is the difference between ARRAY and STACK?   3
    d) Arrays are called dense list and static data structure. Why?   3
    e) Which one is faster? A binary search of an ordered set of elements in an array or a sequential search of the elements.   3

2. a) Which of the following statements will correctly store the concatenation of strings s1 and s2 in string s3?   5
        i)   s3=strcat(s1,s2);
        ii)   strcat(s3,s2,s1);
        iii)   strcpy(s3, strcat(s1, s2));
        iv)   strcmp(s3, strcat(s1, s2));
        v)   strcpy(strcat(s1,s2), s3);
    b) What is Recursion? Explain with an example.   4
    c) Write a program which reads words WORD1 and WORD2 and then replaces each occurrence of WORD1 in TEXT by WORD2. Test the program using WORD1='HENCE' and WORD2='THUS'.   6

3. a) Derive the best, average, worst case time complexity of a linear search.   3
    b) Develop an algorithm for binary search. Validate the algorithm with a suitable data set.   9
    c) What is Top down approach? Explain.   3

4. a) Convert the expression ((A+B)*C-(D-E)^(F+G)) to equivalent Prefix and Postfix notations.   10
    b) Write a searching algorithm that finds an item from list.   5

1. a) Define the following terms with proper example.   10
        i.   Binary tree
        ii.   Complete binary tree
        iii.   Extended binary tree
        iv.   Binary search tree
        v.   Depth of a tree
    b) What are the advantages & disadvantages of a doubly linked list over a   5
        singly linked list?

2. a) Consider the following queue of characters, where queue is a circular   7.5
        array which is allocated six memory cells:
        front=3, rear=5 queue: _, _, c, d, e, _
        Describe the queue as the following operations take place:
        i.   f is added to the queue.
        ii.   two letters are deleted.
        iii.   k, l and m are added to the queue.
        iv.   two letters are deleted
        v.   r is added to the queue.
    b) Write an algorithm to perform queue insert operation.   4.5
    c) Define priority queue. Write the two rules for priority queues.   3

3. a) Define path length. Show the relationship between internal and external   5
        path length of an extended binary tree.
    b) Write an algorithm that inserts an item to the heap.   5
    c) Briefly describe about Huffman's Algorithm.   5

4. a) Define graph and multigraph.   2
    b) Write in detail about the Breadth first search of a graph.   8
    c) Suppose a graph G is stored in memory as follows: 5

		NODE	NEXT	ADJ
START	1	A	4	6
6	2		0	
	3	C	8	1
AVAILN	4	E	0	10
5	5		7	
	6	D	·3	2
	7		2	
	8	B	1	9

DEST	8	8		1	4	3	3		6	3	AVAILE
LINK	5	7	8	0	0	0	0	0	4	0	3
	1	2	3	4	5	6	·7	8 ·	9	10	

Draw the graph G.

Hajee Mohammad Danesh Science and Technology University, Dinajpur
Department of Computer Science and Engineering
Semester Final Examination 2016 (Jan-Jun)
B.Sc. in Computer Science and Engineering
Level 2, Semester I, Course Code: CSE 201, Credit: 3.0
Course Title: Data Structures

Total Marks: 90

Time: 3 Hours

Section A

Answer any THREE

1. a) Define data and data structure. Write two applications for each of the following data structures: i) linked list, ii) queue, and iii) tree.   2+3
   b) One dimensional array is the simplest data structure; explain why?   3
   c) Write about the three cases that an algorithm might face with an example. Write an algorithm to find the smallest element in an array.   4+3

2. a) Compare one dimensional array with linked list   3
   b) When do overflow and underflow happen in linked list?   3
   c) What does free storage list do? What is garbage collection?   3+2
   d) Define two way linked list with diagram.   4

3. a) Write benefits of polish notation. Convert the following infix notation to prefix notation. a*b*c+d/(e-f)   2+3
   b) Solve the following postfix expression P using a stack (show the steps).   5
   P: 5, 3, +, 2,*, 6, 9, 7, -, /,-
   c) Suppose the following stack STACK has 10 memory cells: 5
   STACK: 10, 20, 30, 40, __, __, __, __, __, __.
   TOP= 4.
   Find the output of the following algorithm segment (PUSH() and POP() are used to push and pop an element into/from the STACK).
   Step 1: Call POP(STACK).
        Call POP(STACK).
        Call PUSH(STACK, 90).
        Call PUSH(STACK, 80).
        Call PUSH(STACK, 70).
   Step 2. Repeat while TOP≠0:
        Call POP(STACK).
        Print: item.
        [end of loop.]

4. a) Why selection sort is called so? Consider the following numbers and sort them using selection sort algorithm.   2+5
   22 33 11 55 44 66
   b) "Data modification is closely related to searching". Explain it.   3
   c) Which method is used by the quick sort algorithm? Explain with example.   2+3

Section B

Answer any THREE

1. a) What is priority queue? Write the rules in order to process an element of a priority queue.   2+3

   b) Suppose a queue QUEUE has 8 memory elements with the elements 5, 10, and 15; where FRONT=2 and REAR=5. Now answer the following questions.   2+2 +1+1

       i. What would be the values of FRONT and REAR, if two elements 44 and 55 are inserted?

       ii. Now delete two elements from the QUEUE. Write the values of FRONT and REAR again.

       iii. When will 15 be deleted before 10?

       iv. When the QUEUE will be overflowed; write the condition.

   c) Write an algorithm to implement the delete operation for a queue.   4

2. a) Differentiate between binary tree and general tree.   3

   b) Draw all the possible trees of T where T is a binary tree with 3 nodes.   5

   c) Build a heap using the following numbers.   4+3

       12 24 36 6 12 18

   Now delete the root of the heap and rebuild it.

3. a) Following is an adjacency matrix A for a graph G with four nodes a, b, c, d, and e. Draw the graph. What are the drawbacks of representing a graph by such matrix?   2+2

   $$A = \begin{matrix} 0\ 1\ 1\ 0\ 0 \\ 0\ 0\ 0\ 1\ 1 \\ 0\ 0\ 0\ 1\ 0 \\ 0\ 0\ 0\ 0\ 1 \\ 0\ 0\ 1\ 0\ 0 \end{matrix}$$

   b) Explain the linked representation of the graph G given in the previous question.   6

   c) Draw a directed graph and discuss how the breath first search algorithm works for it.   5

4. Write short notes (any three).   3x5

   i. Data structure operations

   ii. Binary search tree

   iii. Binary search

   iv. Radix sort

Hajee Mohammad Danesh Science and Technology University, Dinajpur
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B.Sc in CSE
Semester Final Examination 2015(Jan-June)
Level 2 Semester I, Course Code: CIT 201, Credit: 3.0
Course Title: Data Structures (Theoretical)

Time: 3 Hours   Total Marks: 90

[N.B. The figure in the right margin indicates the marks for respective question]

Section-A
Answer any **THREE**

1. a) Define data structure. Write the name of basic operations performed in data structure. 4

   b) What factors effect the complexity of an algorithm? 2

   c) Explain why the statement: "The running time of algorithm A is at least $O(n^2)$" is meaningless. 3

   d) Differentiate between best, average and worst case complexities. 3

   e) Find (i) INSERT ('AAAAA' , 3 , 'BBB') 3

         (ii) DELETE ('JOHN PAUL JONES', 6, 5)

         (iii) REPLACE ('AAABBB', 'AB, 'CC').

2. a) What is an array? How linear arrays are represented in memory? Explain. 4

   b) Using the bubble sort algorithm, find the number of comparisons which alphabetize the n=6 letters in PEOPLE. 4

   c) Write an algorithm for Binary Search technique. Apply the algorithm on an ordered array A with the following elements {11, 22, 30, 33, 40, 44, 55, 60, 66, 77, 80, 88, 99}. Determine the number of key comparisons made while searching for keys 40 and 85. 7

3. a) Define linked list with schematic diagram. 2

   b) How can we handle overflow and underflow in linked list? 3

   c) What do you understand by garbage collection? 2

   d) Consider the following arithmetic infix expression Q. 4
   $$Q = A + (B * C - (D / E - F) * G) * H$$
   Convert infix expression Q into equivalent post expression using stack.

e) Consider the linear arrays AAA (5:50) and BBB (-5:10).   4

    i) Find the number of elements in each array.

    ii) Suppose Base (AAA) = 300 and w=4 words per memory cell for AAA.
       Find the address of AAA [15] and AAA [55].

4. a) Define Queue. Why queue is called first in first out system?   2

  b) Write an algorithm to insert an element to a queue.   4

  c) Consider the following queue of characters, where QUEUE is a circular array   3
    which is allocated six memory cells:

    FRONT=2, REAR=4   QUEUE: _, A, C, D, _, _

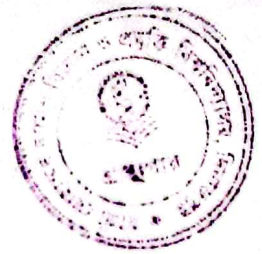   Describe the queue as the following operations take place:

      i) F is added to the queue.

      ii) Two letters are deleted.

      iii) K, L and M are added to the queue.

  d) Write an algorithm for finding solution to Tower's of Hanoi problem. Explain the   6
    working of the algorithm for 3 disks.

———————

1. a) Define Complete binary tree with an example.   2

    b) How many ways a binary tree can be represented in memory? Briefly describe one   4 of them.

    c) Given a sequence S containing the elements 40, 60, 50, 33, 55 and 11. Insert these   4 elements in the given order into an initially empty Binary Search tree.

    d) Define maxheap and minheap? Build a Heap from the following list of numbers: 44,   5 30, 50, 22, 60, 55, 77 and 55.

2. a) Define Extended binary tree with an example.   2

    b) From the Huffman's algorithm prove that $L_E = L_I + 2n$.   4

    c) Suppose A, B, C, D, E and F are 6 data items and their corresponding weight as   5 follows:

     Data item: A   B   C   D   E   F

      Weight: 4   15   25   5   8   16

     Construct the tree by using Huffman's algorithm.

    d) Describe in brief, Divide-and-Conquer method.   4

3. a) Define the following terms with an example.   3

      i) Graph   ii) Multigraph   and   iii) Directed graph

    b) Prove that a complete graph with n nodes will have n(n-1)/2 edges.   3

    c) Define adjacency matrix. Below an adjacency matrix is given, the nodes are X, Y, Z   3 and W. Construct the digraph.

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

d) A graph is stored in memory as follows:

NODE	A	B		E		D	C	
NEXT	7	4	0	6	8	0	2	3
ADJ	1	2		5		7	9	
	1	2	3	4	5	6	7	8

START = 1 AVAILN = 5

DEST	2	6	4		6	7	4		4	6
LINK	10	3	6	0	0	0	0	4	0	0
	1	2	3	4	5	6	7	8	9	10

Draw the Graph.

6

4. **a)** Define sorting and searching.

2

b) Given the following array:

80 72 66 44 21 33

After two passes of a sorting algorithm the array has been rearranged as shown below:

21 33 80 72 66 44

Which sorting algorithm is being used (selection, bubble, insertion). Defend your answer.

3

c) Sort the following elements using Selection sort algorithm.

77, 33, 44, 11, 88, 22, 66, 55

4

d) Discuss Radix sort method with an example.

6

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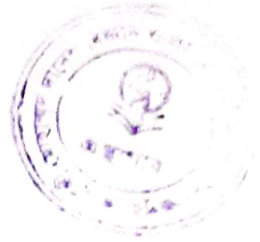1. a) Define the following terms with proper example.   10
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4	E	0	10
5		7	
6	D	3	2
7		2	
8	B	1	9

START
6

AVAILN
5

DEST	8	8		1	4	3	3		6	3	AVAILE
LINK	5	7	8	0	0	0	0	0	4	0	3
	1	2	3	4	5	6	7	8	9	10	

Draw the graph G.

Hajee Mohammad Danesh Science and Technology University, Dinajpur.
Department of Computer Science and Engineering
B.Sc. (Engineering) in Computer Science & Engineering
Special Repeat Examination 2020 (Old Syllabus)
Level 2 Semester I
Course Code: CSE 201 Credits: 03
Course Title: Data Structures (Theoretical)

Time: 3 Hours   Total Marks: 90

[N.B. The figure in the right margin indicates the marks for respective question and Split answer of any question is unacceptable]

Section-A
Answer any Three

1. a) What is data structure? List out the areas in which data structures are applied extensively.   1+2
    b) Define algorithm and the complexity of an algorithm. What are the characteristics of an algorithm?   2+3
    c) Write down the algorithm and also the complexity of Linear Search algorithm.   5+2

2. a) What is the difference between ARRAY and STACK?   04
    b) Arrays are called dense list and static data structure. Why?   2+2
    c) Define priority queue. Show the link representation of a priority queue. 2+5

3. a) Write an algorithm that finds the product AB of matrices A and B, which are stored as two-dimensional arrays.   07
    b) Using the quick sort algorithm, find the number C of comparisons and the number D of interchanges which alphabetize the n=6 letters in ALMOST. 4+4

4. a) Define underflow, overflow and garbage collection.   03
    b) State & explain the algorithm to perform Bubble Sort.   4+4
    c) Also analyze the time complexity of bubble sort algorithm.   04

1. a) What does Big O notation do?   03
   b) Write an algorithm for binary search.   07
   c) Define Complete binary tree with example.   05

2. a) Define recursion with example. What are the requirements for a recursive function?   1+2
   b) What is Huffman's Algorithm? Suppose A, B, C, D, E, F, G and H are 8 data items, and suppose they are assigned weights as follows: 4+4
   Data item: A   B   C   D   E   F   G   H
   Weight: 22   5   11   19   2   11   25   5
   Construct the tree T with minimum-weighted path length using the Huffman's algorithm.
   c) If the weights represent the percentage probabilities that the items will occur, then construct the tree and show the efficient coding of the data items.   04

3. a) Draw a binary tree from the following algebraic expression.   04
   (a-b)/((c*d)+e)
   b) Define circular header linked list and free storage list with proper example.   2+2
   c) Write a post order traversal algorithm for binary tree.   07

4. a) Describe the adjacency matrix of a graph.   03
   b) Briefly describe the Depth First Search (DFS) algorithm with proper example.   12