2nd Year 1st Semeter Examination-2020
Department of Computer Science and Engineering
Islamic University, Kushtia

Course Code: CSE 2103 **Course Title: Algorithms**

Time: 04 Hours Full Marks: 70

Answer any five of the following:

1.	a)	Define algorithm. Explain the properties of an algorithm with an example.	5
	b)	Show that $10n^2 + 4n + 2 = O(n^2)$	3
	c)	Distinguish between Algorithm and Pseudocode.	3
	d)	What do you mean by average-case & worst-case complexity of an algorithm. Give an example	2
2.	a)	What is Backtracking?	3
	b)	Draw the state – space tree for 4-queens problem.	5
	c)	Write an algorithm for sum of subset problem using backtracking. Also solve the following instance of sum of subset problem: S ={1,5,2,7} with d = 8.	6
3.	a)	Define the following data structures: stacks, queues, Trees and Heaps	6
	b)	Define binary search tree with its satisfying properties. Give an example.	3
	c)	Write an algorithm to search an item in a binary search tree. Find its complexity with Big Oh notation.	5
4.	a)	What do you understand by divide and conquer strategy? Give an example.	4
	b)	Solve the following recurrence relation with a=2, b=2, T(1)=2 and f(n)=n $T(n) = \begin{cases} T(1) & n = 1 \\ aT\left(\frac{n}{b}\right) + f(n) & n > 1 \end{cases}$	5
	c)	Show the steps in Quick sort algorithm to sort the following sequence: 57, 24, 78, 29, 67, 22, 18, 89	5
5.	a)	Define greedy method.	2
	b)	The following table shows the data about the number of tasks. Each task has a start time and a finish time. Consider the supply of machines to perform the task is infinite. Discuss the scheduling operations of the tasks to machines using greedy method.	6

task	a	b	c	d	e	f	g
start	0	3	4	9	7	1	6
finish	2	7	7	11	10	5	8

	c)	Define spanning tree. Consider the following graph. Show the stages in Kruskal's algorithm to obtain the minimum-cost spanning tree from the graph.	6
6.	a)	What do you mean by dynamic programming? Write the steps to design a dynamic programming algorithm.	5
	b)	Write down a dynamic programming algorithm for finding the length of the longest common subsequence (LCS) problem.	6
	c)	Differentiate between greedy method and dynamic programming approach.	3
7.	a)	Define the following terms: i) Inorder traversal, ii) Preorder traversal, iii) Postorder traversal.	3
	b)	Write algorithms for preorder and postorder traversals	6
	c)	Describe the Depth First Search (DFS) technique for a graph. Write also the pseudo code for the technique.	5
8.	a)	What are NP hard problems? Write short notes on the procedures of the following approximation algorithms to solve TSP using suitable examples. i) Nearest Neighbor algorithm ii) Twice-around-the-tree algorithm	7
	b)	Write an algorithm to check whether a cycle is Hamiltonian cycle.	7

B.Sc. (Honors') 2nd year 1st semester Final Examination-2019
Dept. of Computer Science and Engineering
Course No. CSE-2103
Course Title: Algorithms
Full Marks: 70 **Time: 04 Hours**

(Answer any five questions.)

1. (a) Define algorithm. Describe the criteria that all algorithms must satisfy. 5
   (b) Define the terms i) Algorithm validation, ii) Program verification, iii) Debugging, and iv) Profiling 6
   (c) Write the difference between an algorithm and a program 3

2. (a) What is asymptotic notation? Write a list of asymptotic notations used to describe the complexity of an algorithm. 4
   (b) Write the difference between O(n) and $\theta(n)$ with example. 3
   (c) Prove that if the complexity of an algorithm is expressed by the polynomial $a^m n^m \ldots\ldots\ldots\ldots + a_1 n + a_0$ then its complexity is denoted by $O(n^m)$. 5
   (d) What is an iterative algorithm? 2

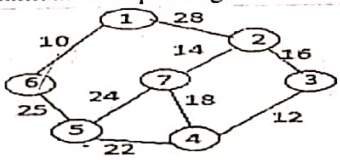
3. (a) Define the following data structures: stacks, queues, Trees and Graphs 2
   (b) Define binary search tree with its satisfying properties. Give an example. 2
   (c) Briefly explain randomized algorithm. 3
   (d) Write an algorithm to find and delete a given ITEM in a binary search tree. Also show that its complexity with Big Oh notation. 7

4. (a) Explain divide and conquer strategy for solving a problem. Write a list of algorithms that can follow divide and conquer technique. 5
   (b) Derive an expression for time complexity of a divide and conquer strategy. 3
   (c) Write the pseudo code for sorting a given list of numbers using quicksort algorithm, also express its complexity using asymptotic notation. 6

5. (a) Define greedy method. 2
   (b) The following table shows the data about the number of tasks. Each task has a start time and a finish time. Consider the supply of machines to perform the task is infinite. Discuss the scheduling operations of the tasks and machines using greedy method. 6

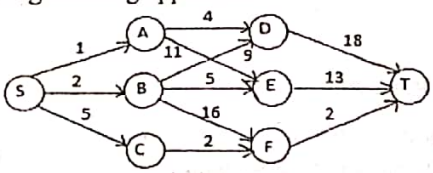
task	a	b	c	d	e	f	g
start	0	3	4	9	7	1	6
finish	2	7	7	11	10	5	8

   (c) Define spanning tree. Consider the following graph. Show the stages in Kruskal's algorithm to obtain the minimum-cost spanning tree from the graph. 6



6. (a) Define the following terms: i) Inorder traversal, ii) Preorder traversal, iii) Postorder traversal. 3
   (b) Write algorithms for preorder and postorder traversals for a tree. 6
   (c) Differentiate between DFS and BFS for a graph. Write also the pseudo code for the BFS technique. 2+3

7. (a) What do you mean by dynamic programming? Write down the steps for dynamic programming. 2+3
   (b) Define multistage graph. Consider the following graph. Identify the shortest path from S to T using dynamic programming approach. 7



   (c) Differentiate between greedy method and dynamic programming approach. 2

8. Write short note on the followings:
   (i) Merge sort
   (ii) 8-Queen problem
   (iii) Greedy approach
   (iv) Backtracking algorithm

$3\frac{1}{2} \times 4 = 14$

Night
2017-18

2nd Year Final Examination-2018
Department of Computer Science and Engineering
Islamic University, Kushtia
Course Code: CSE 202 Course Title: Algorithms

Time: 04 Hours Full Marks: 75

Answer any five of the following

1. (a) Define algorithm. Describe the criteria that all algorithms must satisfy. 5
   (b) Define the terms i) Algorithm validation ii) Program verification iii) Debugging iv) Profiling 6
   (c) What do you understand by recursive algorithm? Give an example. 4

2. (a) Define the asymptotic notations used in complexity analysis. 6
   (b) Prove that if $f(n) = a_m n^m + \ldots\ldots\ldots\ldots + a_1 n + a_0$ then $f(n) = O(n^m)$. 4
   (c) Write the selection sort algorithm and discuss its complexity 5

3. (a) Define the following data structures: Stacks, Queues, Trees and Heaps 6
   (b) Define binary search tree with its satisfying properties. Give an example. 3
   (c) Write an algorithm to search an item in a binary search tree. Find its complexity with Big O notation. 6

4. (a) Define NP, NP hard and NP complete. Give example of each. 6
   (b) Show that Hamiltonian cycle is in NP class of problem. 4
   (c) Describe the FIFO and LC branch and bound algorithm. 5

5. (a) What is greedy algorithm? Write its pseudo code prove that fractional Knapsack problem has a greedy-choice property. 8
   (b) Explain dynamic programming. Apply it on matrix Chain-multiplication problem. 7

6. (a) Define the following terminologies: 3
   Sibling, Parent, Depth, Level, Leaf and Degree.
   (b) Briefly describe the different standard ways of traversing of a binary tree. Give examples. 6
   (c) Solve the shortest path problems using Dijkastra's algorithm. Count the number of distance updates. 6

7. (a) Define Hamiltonian cycles and planar graph with example. 2+2
   (b) Describe the backtracking algorithm that finds all the Hamiltonian cycles in a graph. 6
   (c) Write a backtracking algorithm for the sum of subsets problem. 5

8. Write short notes on the following: 3×5
   (a) Merge sort
   (b) Divide-and-Conquer algorithm
   (c) 8-queens problem

2nd Year B.Sc. (Hons.) Final Examination- 2017

Dept. of Computer Science and Engineering

Islamic University, Kushtia

Course Title: Algorithms, Course Code: CSE 202

Full Marks: 75 Time: 04 Hours

[Answer any five of the following questions. Figures in the right margin indicate marks.]

1.	a)	Differentiate between algorithm and programs.	3
		Explain the importance of algorithms design to the students of computer science.	3
	c)	Explain the criteria that must be satisfied by an algorithm.	5
	d)	Explain the criteria that must be satisfied by an algorithm.	4
		Write the criteria that can be used to judge an algorithm.	
2.	a)	Define the asymptotic notations used in complexity analysis.	6
	b)	Show that $10n^2 + 4n + 2 = O(n^2)$	4
	c)	Write a recursive algorithm to calculate the sum of the array elements of size n and find its complexity.	5
3.	a)	Define randomized algorithm. Write some advantages of it.	3
	b)	Write the differences between iterative and recursive algorithms.	3
	c)	Write and explain recursive algorithm for finding the factorial of a given integer.	5
	d)	Derive an expression for time complexity of the recursive algorithm in question 3.c).	4
4.	a)	What do you understand by divide and conquer strategy? Give an example.	4
	b)	Solve the following recurrence relation with a=2, b=2, T (1) =2 and f(n)=n $T(n) = \begin{cases} T(1) & n = 1 \\ aT\left(\frac{n}{b}\right) + f(n) & n > 1 \end{cases}$	5
	c)	Show the steps in Quick sort algorithm to sort the following sequence: 57, 24, 78, 29, 67, 22, 18, 89	6
5.	a)	What do you mean by greedy strategy?	2
	b)	Define graph and digraph with examples.	4
	c)	Write a greedy algorithm for finding the shortest path from some vertex u to vertex v in a digraph G of n vertices.	6
	d)	What s multistage graph? Give an example.	3
6.	a)	What do you mean by dynamic programming? Write the steps to design a dynamic programming algorithm.	6
	b)	Write down a dynamic programming algorithm for finding the length of the longest common subsequence (LCS) problem.	6
	c)	Differentiate between greedy method and dynamic programming approach.	3
7.	a)	Define the following terms: i) Inorder traversal, ii) Preorder traversal, iii) Postorder traversal.	3
	b)	Write algorithms for preorder and postorder traversals.	6
	c)	Describe the Depth First Search (DFS) technique for a graph. Write also the pseudo code for the technique.	6
8.		Write short notes on the following:	3x5
		i) Merge sort	
		ii) Knapsack Problem	
		iii) Backtracking algorithm	

Islamic University
2nd Year Final Examination-2016
Department of Computer Science and Engineering
Course Code: CSE 202
Course Title: Algorithms

Time: 04 Hours | Full Marks: 75

Answer any five of the following:

1. a) Define algorithm. Describe the criteria that all algorithms must satisfy. 5
   b) Define the terms i) Algorithm validation, ii) Program verification, iii) Debugging, and iv) Profiling 4
   c) Mention the criteria upon which you can judge an algorithm. 3
   d) Define step count. Count the number of steps of the following statement. 3

```
return a+b+c*C+(a+b-c)+4.0i
```

2. a) Briefly describe different asymptotic notations used in complexity analysis. 6
   b) Prove that if $f(n) = a_m n^m + \ldots\ldots\ldots\ldots + a_1 n + a_0$, then $f(n) = O(n^m)$. 3
   c) Write a recursive algorithm to find the maximum and minimum of n numbers and discuss its complexity analysis. 6

3. a) Define the following data structures: stacks, queues, Trees and Heaps 4
   b) Define binary search tree with its satisfying properties. Give an example. 2
   c) Briefly explain randomized algorithm. 3
   d) Write an algorithm to find and delete a given ITEM in a binary search tree. Also find its complexity with Big Oh notation. 6

4. a) Explain divide-and-Conquer strategy with an example. 4
   b) Suppose you have given a list of a elements: 2+3=5

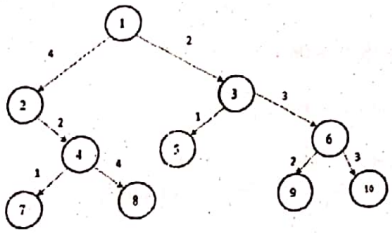
      a: 22, 13, -5, -8, 15, 60, 17, 31.

      i) Build a tree using recursive calls on the list for finding the maximum and minimum.

      ii) Find the number of comparisons needed for Maximum.

   c) Write quicksort algorithm. On which input does the quicksort algorithm exhibit its worst-case behavior? 4+2=6

5. a) Suppose you have given a weighted tree. 2



Construct a tree after splitting the nodes which required for $\delta = 5$ from the trees.

   b) The following table shows the data about the number of tasks. Each task has a start time and a finish time. Consider the supply of machines to perform the task is infinite. Discuss the scheduling operations of the tasks and machines using greedy method. 5

task	a	b	c	d	e	f	g
start	0	3	4	9	7	1	6
finish	2	7	7	11	10	5	8

   c) Define spanning tree and write its application. 3
   d) Write Prim's algorithm to obtain the minimum-cost spanning tree from the graph. 5

6. a) What do you mean by dynamic programming? Write the steps to design a dynamic programming algorithm. 2+4=6
   b) Define multistage graph. Consider the following graph. Identify the shortest path from S to T using dynamic programming approach. 7

B.Sc. (Hon's) 2nd Year Final Examination-2015

Dept. of Computer Science and Engineering
Islamic University, Kushtia

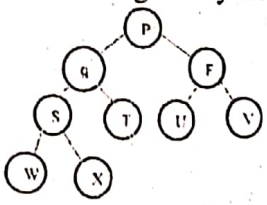
CSE 202: Computer Algorithm

Full Marks: 75 Time: 4 hours

Answer any five questions
(Figures in the right margin indicate marks)

1. (a) What is algorithm? 2
   (b) Write the criteria that any algorithm satisfies. 3
   (c) What is recursive algorithm? What is the basic difference between direct and indirect recursive algorithm. 4
   (d) Write the criteria upon which you can judge an algorithm. 3
   (e) What do you understand by time space complexity? Define Big "O" notation. 3

2. (a) What do you mean by randomized algorithm? Write the advantages and disadvantages of randomized algorithm over deterministic algorithms? 5
   (b) What is the different between stack and queue? Explain the basic add and delete operation on stack. 5
   (c) Define binary tree and completely binary tree with examples. Show the sequential representation of the following binary tree:



3. (a) What do you mean by minheap? Write the pseudocode for inserting an item into a heap. 4
   (b) Suppose you have given the list of the following numbers: {40, 80, 35, 85, 50, 45, 70}, Construct a heap from the set of integers. 3
   (c) Write the pseudocode for sorting a given list of numbers using quick sort algorithm. 5
   (d) Define sorting and searching. 3

4. (a) Explain divide and conquer strategy with an example. 5
   (b) Derive an expression for time complexity of a divide and conquer strategy. 3
   (c) Define binary search. Write the algorithm of recursive binary search. 7

5. (a) Define i) convex hull and ii) convex polygon. 4
   (b) Suppose there is a line with endpoints P(p_1, p_2) and Q(q_1, q_2). Now there is another point R(r_1, r_2), which is either an the left or right side of the line PQ. How can you determine if the point R is an the left (or right side) of PQ? 3
   (c) Describe the Graham's scan method to find the convex hull of a given set of points. 8

6. (a) Explain quick sort algorithm with example. 5
   (b) Describe the backtracking algorithm. 5
   (c) Explain binary search algorithm. 5

7. (a) Write an algorithm to place 8-queens on a chess-board so that no queen can take another. Also analyze the backtracking of this algorithm. 8
   (b) Explain insertion sort algorithm with an example of 8 numbers. 7

8. (a) Write the greedy algorithm to generate shortest paths. 5
   (b) Write an algorithm that finds all Hamilton cycles of a connected graph with backtracking method. 5
   (c) Calculate the complexity of quick sort algorithm. 5

2nd Year B.Sc(Honors) Final Examination-2014
Department of Computer Science and Engineering
Islamic University, Kushtia-7003

Course Code: CSE 202 — Course Title: Algorithms
Time: 04 Hours — Full Marks: 75

Answer any five questions

1. a) Define the terms i) Algorithm validation, ii) Program verification, iii) Debugging and iv) Profiling. 4
   b) Explain the asymptotic notations used in complexity analysis. 6
   c) Write a recursive algorithm to calculate the sum of the array elements of size n and find its complexity. 5

2. a) Define the following data structures: stacks, queues and trees 6
   b) Build a Heap from the following list of numbers: 44, 30, 50, 22, 60, 55, 77, 55 3
   c) Determine the complexity of Heap sort. 3
   d) Explain the technique to insert an item to a binary tree. 3

3. a) Define Hamiltonian cycles and planar graph with example. 5
   b) Give an algorithm that finds all the Hamiltonian cycles in a graph. 5
   c) Show the different steps of a backtrack solution to the 4 queens problem. 5

4. a) What do you understand by divide and conquer strategy? Give an example. 4
   b) Solve the following recurrence relation with a=2, b=2, T(1)=2 and f(n)=n 5

$$T(n) = \begin{cases} T(1) & n=1 \\ aT\left(\frac{n}{b}\right) + f(n) & n>1 \end{cases}$$

   c) Show the steps in Quick sort algorithm to sort the following sequence: 57, 24, 78, 29, 67, 22, 18, 89. 6

5. a) Define greedy method. 2
   b) The following table shows the data about the number of tasks. Each task has a start time and a finish time. Consider the supply to machines to perform the task is infinite. Discuss the scheduling operations of the tasks to machines using greedy method. 6

Task	a	b	c	d	e	f	g
Start	0	3	4	9	7	1	6
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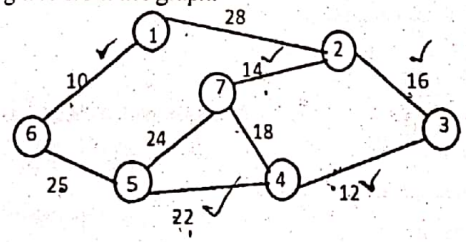
   c) Define spanning tree. Consider the following graph. Show the stages in Kruskal's algorithm to obtain the minimum-cost spanning tree from the graph.



6. a) What do you mean by dynamic programming? Write the steps to design a dynamic programming algorithm. 5
   b) Write down a dynamic programming algorithm for finding the length of the longest common subsequence (LCS) problem. 5
   c) Differentiate between greedy method and dynamic programming approach. 3
   d) Define multistage graph. 2

7. a) Define the following terms: i) In-order traversal, ii) Pre-order traversal and iii) Post-order traversal. 3
   b) Write algorithms for pre-order and post-order traversals. 6
   c) Describe the depth first search (DFS) techniques for a graph. Write also the pseudo code for the technique. 6

8. Write short note on any three of following 3x5
   i) Backtracking Algorithm
   ii) Knapsack problem
   iii) NP-Complete and NP-hard problem
   iv) 8-Queens Problem.