MID-TERM EXAMINATION PAPER

FACULTY : COMPUTER SCIENCE AND MULTIMEDIA

COURSE : BACHELOR OF INFORMATION TECHNOLOGY(BIT)

YEAR/ SEMESTER : SECOND YEAR / FOURTH SEMESTER

MODULE TITLE : FUNDAMENTAL OF ALGORITHMS

DATE : 4TH MARCH 2022

TIME ALLOWED : 3 HOURS

START : 6:30 AM – 09:30 AM

SET : B

Instruction to candidates

1. This question paper has THREE (3) Section

2. Answer **ALL** questions in Section A, MCQ.

3. Answer **5** questions in Section B, MSAQ

4. Answer **2** questions in Section C, MEQ

5. No scripts or answer sheets are to be taken out of the Examination Hall.

6. For Section A, answer in the OMR form provided.

Do not open this question paper until instructed.

(Candidates are required to give their answers in their own words as far as practicable)

Multiple Choice Questions (30*1=30)

1. What is the time complexity of the following code:
   ```
   int a = 0, b = 0;
   for (i = 0; i < N; i++) {
       a = a + rand();
   }
   for (j = 0; j < M; j++) {
       b = b + rand();
   }
   ```
   a. O(N * M) time
   b. O(N + M) time
   c. O(N + M) time
   d. O(N * M) time

2. What is the time complexity of the following code:
   ```
   int a = 0;
   for (i = 0; i < N; i++) {
       for (j = N; j > i; j--) {
           a = a + i + j;
       }
   }
   ```
   a. O(N)
   b. O(N*log(N))
   c. O(N * Sqrt(N))
   d. O(N*N)

3. Two main measures for the efficiency of an algorithm are:
   a. Processor and memory
   b. Complexity and capacity
   c. Time and space
   d. Data and space

4. Which of the following case does not exist in complexity theory?
   a. Best Case
   b. Null Case
   c. Average Case
   d. Worst Case

5. The heart of Quick Sort algorithm is _____
   a. Building a Max Heap
   b. Building a Min Heap
   c. Partitioning the array
   d. Merge Process

6. What is the typical running time of a heap sort algorithm?
   a. O(n log n)
   b. $O(n^2)$
   c. O(log n)
   d. O(n)

7. Here, the Stable property of Sorting algorithm is defined as: A stable sort is one with which conserve original order of input set. Which of the statement below is correct?
   a. Merge sort and Heap sort both are stable
   b. Merge sort and Heap Sort both are unstable
   c. Merge sort is stable but Heap sort is unstable
   d. Merge sort is unstable but Heap sort is stable

8. Running merge sort on an array of size n which is already sorted is:
    a. O(n lg n)
    b. O (n)
    c. O(1)
    d. O(n*n)

9. For the improvement of efficiency of quick sort, the pivot can be:
    a. First Element
    b. Last Element
    c. Median Element
    d. Any Element

10. Heap is defined to be a :
    a. Complete Binary Tree
    b. Tree Structure
    c. Binary Tree
    d. Left Skewed Binary Tree

11. Suppose we need to sort a list of students records in ascending order, using the student id as the key (i.e., sort the records by students id). If we need to guarantee that the running time will be no worse than n log n, which sorting methods could we use?
    a. Quick Sort
    b. Either Merge or Quick Sort
    c. Selection Sort
    d. Merge Sort

12. Which of the following sorting algorithm has the worst time complexity of (n log n)?
    a. Selection Sort
    b. Quick Sort
    c. Heap Sort
    d. None of the above

13. The average case of quick sort has order:
    a. O(n*n)
    b. O(n lg n)
    c. O(lg n)
    d. O(1)

14. Which of the following best describes the useful criterion for comparing the efficiency of algorithms?
    a. Time
    b. Memory
    c. Both of the above
    d. None of the above

15. Algorithm A and B have a worst-case running time of O(n) and O(logn), respectively. Therefore, algorithm B always runs faster than algorithm A.
    a. True
    b. False
    c. Both runs equally
    d. None

16. Which of the following algorithms is the best approach for solving Huffman codes?
    a. Exhaustive search
    b. Greedy algorithm
    c. Brute force algorithm
    d. Divide and conquer algorithm

17. Which bit is reserved as a parity bit in an ASCII set?
    a. First
    b. Seventh
    c. Eighth
    d. Tenth

18. In Huffman Coding, the code length does not depend on the frequency of occurrence of characters.
    a. True
    b. False

19. Time Complexity of Breadth First Search is? (V – number of vertices, E – number of edges)
    a. O(V + E)
    b. O(V)
    c. O(E)
    d. O(V*E)

20. The Data structure used in standard implementation of Breadth First Search is?
    a. Stack
    b. Queue
    c. Linked List
    d. Tree
21. The Breadth First Search traversal of a graph will result into?
    a. Linked List
    b. Tree
    c. Graph with back edges
    d. Arrays
22. A person wants to visit some places. He starts from a vertex and then wants to visit every place connected to this vertex and so on. What algorithm he should use?
    a. Depth First Search
    b. Breadth First Search
    c. Trim's algorithm
    d. Kruskal's algorithm
23. Which of the following is not an application of Breadth First Search?
    a. Finding shortest path between two nodes
    b. Finding bipartiteness of a graph
    c. GPS navigation system
    d. Path Finding
24. Which of the following data structure is non linear type?
    a. Strings
    b. Lists
    c. Stacks
    d. Graphs
25. Match the following:
    a) Completeness

    b) Time Complexity

    c) Space Complexity

    i) How long does it take to find a solution

    ii) How much memory need to perform the search.

    iii) Is the strategy guaranteed to find a solution when there is none?

    a. a-iii, b-ii, c-i
    b. a-i, b-ii, c-iii
    c. a-iii, b-i, c-ii
    d. a-i,b-iii,c-ii
26. A graph is a collection of nodes, called_____ and line segments called arcs or_____ that connect pair of nodes.
    a. Vertices, edges
    b. Edges, vertices
    c. Vertices, paths
    d. Graph node, edges
27. In a min-heap:
    a. Parent nodes have values greater than or equal to their childs
    b. Parent nodes have values less than or equal to their childs
    c. Both statements are true
    d. Both statements are wrong
28. Greedy Algorithm works on:
    a. Top-Down Approach
    b. Bottom-Up Approach
    c. Right Left Approach
    d. Left Right Approach
29. _____ is filled with either 0 or 1 or -1.
    a. Adjacency matrix
    b. Incidence matrix

c. Adjacency List   d. Only 0 and 1 are used.

30. An algorithm that calls itself directly or indirectly is known as:
    a. Sub Algorithm   c. Polish Notation
    b. <mark>Recursion</mark>   d. Traversal algorithm

SECTION B
Short Question Answer

Attempt any five (5) questions out of eight (8) questions   **(5*6=30)**

1. Define Algorithm. How can a solution devised be considered as an algorithm? (Unit 1)
2. Describe RAM Model of computation. (Unit 2)
3. Analyze selection sort with an example. (Unit 4)
4. Define Graph. How are graphs represented? (Unit 5)
5. Explain BFS and complexities of BFS. (Unit 5)
6. Explain Huffman Coding using suitable example of your own. (Unit 5)
7. Show: f(n)=O(g(n)) if,
    a. f(n)= $3n + 2$ and g(n) = n
    b. f(n) = $3n^2 + 4n - 2$ and g(n)=n^2
8. Explain Heap Sort.

SECTION C
Long Question Answer

Attempt any two (2) questions out of three (3) questions   **(2*20=40)**
     (Case study is Compulsory)

1. Case Question
   a. Calculate number of bits required to store the characters in memory initially without using any technique. (2)
   b. How can we reduce the number bits for the above characters to store in memory? Show by tracing. (15)
   c. How many bits are needed to store the characters shown in table above using the technique you traced? (3)

Characters	Frequencies
a	10
e	15
i	12
o	3
u	4
s	13
t	1

2. How is the efficiency of algorithm analyzed? What are the efficiency measures and in what basis are algorithm analyzed? Explain the notations along with examples used in algorithm analysis. (2 +3+15)

3. What is Divide and Conquer Strategy? Explain Quick Sort along with its best, average and worst case. Give an example for each case. (3+ 17)

Best of Luck