



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 : A

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)

SECTION A

Multiple Choice Questions

(30*1=30)

- Which of the two sorting algorithms have the lowest worst-case complexity?
 - Heap Sort
 - Quick Sort
 - Merge Sort**
 - Selection Sort
- Which one of the following sorting algorithms needs the minimum number of swaps?
 - Merge Sort
 - Selection Sort**
 - Quick Sort
 - Heap Sort
- How many comparisons are needed to sort an array of length 5 if a straight selection sort is used and array is already in the opposite order?
 - 10
 - 20
 - 5
 - 4
- The average case complexity of selection sort is:
 - $O(n \log n)$
 - $O(n^2)$**
 - $O(\log n)$
 - $O(n)$
- Considering an array = {44,34,27,51,26,77,58} , The number of iterations in selection sort is _____.
 - 7
 - 6**
 - 8
 - 5
- Best case complexity of Heap Sort is
 - $O(n \log n)$**
 - $O(n^2)$
 - $O(\log n)$
 - $O(n)$
- What is the worst case time complexity of a quick sort algorithm?
 - $O(n \log n)$
 - $O(n^2)$**
 - $O(\log n)$
 - $O(n)$
- Quick Sort is a _____.
 - Backtracking Algorithm
 - Divide and Conquer Algorithm**
 - Dynamic Programming Algorithm
 - Greedy Approach Algorithm
- _____ is filled with either 0 or 1 or -1.
 - Adjacency matrix
 - Incidence matrix**
 - Adjacency List
 - Only 0 and 1 are used.
- Consider the Quick sort algorithm which sorts elements in ascending order using the first element as pivot. Then which of the following input sequence will require a maximum number of comparisons when this algorithm is applied on it?
 - 14 17 20 27 30 32
 - 17 14 27 20 30 32
 - 14 20 17 30 32 27**
 - 14 17 20 32 27 30
- 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 ?
 - 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
12. Which of the following stable sorting algorithm takes the least time when applied to an almost sorted array?
- a. Quick sort
 - b. Insertion sort
 - c. Selection sort
 - d. Merge sort
13. Greedy Algorithm works on:
- a. Top-Down Approach
 - b. Bottom-Up Approach
 - c. Right Left Approach
 - d. Left Right Approach
14. An algorithm that calls itself directly or indirectly is known as:
- a. Sub Algorithm
 - b. Recursion
 - c. Polish Notation
 - d. Traversal algorithm
15. Quick sort running time depends on the selection of:
- a. Size of array
 - b. Pivot element
 - c. Sequence of values
 - d. None of the above
16. Divide and conquer approaches steps:
- a. divide, conquer and combine
 - b. conquer, divide and combine
 - c. combine, divide and conquer
 - d. none of these
17. An artificial and informal language that helps programmers to develop algorithms, is called:
- a. Instruction Code
 - b. Algocode
 - c. Pseudocode
 - d. Control Code
18. The measure of the longest amount of time possibly taken to complete an algorithm is expressed as ____.
- a. Little-O
 - b. Little-Omega
 - c. Big-Omega
 - d. Big-O
19. A graph is a tree if and only if graph is:
- a. Directed graph
 - b. Contains no cycles
 - c. Planar
 - d. Completely connected
20. You have an array of n elements. Suppose you implement quicksort by always choosing the central element of the array as the pivot. Then the tightest upper bound for the worst-case performance is
- a. $O(n \log n)$
 - b. $O(n^2)$
 - c. $O(\log n)$
 - d. $O(n)$
21. What is the running time of the Huffman encoding algorithm?
- a. $O(C)$
 - b. $O(\log C)$
 - c. $O(C \log C)$
 - d. $O(N \log C)$
22. The type of encoding where no character code is the prefix of another character code is called?
- a. Optimal encoding
 - b. Prefix encoding

- c. Frequency encoding
- d. Trie encoding
23. 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
24. 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. $O(N * \text{Sqrt}(N))$
- d. $O(N * N)$
25. For the improvement of efficiency of quick sort, the pivot can be:
- a. First Element
- b. Last Element
- c. Median Element
- d. Any Element
26. Heap is defined to be a:
- a. Complete Binary Tree
- b. Tree Structure
- c. Binary Tree
- d. Left Skewed Binary Tree
27. Which bit is reserved as a parity bit in an ASCII set?
- a. First
- b. Seventh
- c. Eighth
- d. Tenth
28. In Huffman Coding, the code length does not depend on the frequency of occurrence of characters.
- a. True
- b. False
29. 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. $O(V * E)$
30. The Data structure used in standard implementation of Breadth First Search is?
- a. Stack
- b. Queue
- c. Linked List
- d. Tree

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. What is 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. Define Greedy approach. Explain Huffman Coding. (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
(Case study is Compulsory)

(2*20=40)

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	50
B	10
C	30
D	5
E	3
F	2

2. What is Divide and Conquer Strategy? Explain Merge Sort along with its best, average and worst case. Give an example for each case. (3+17)
3. What do you mean by time complexity? Explain with help of asymptotic notations? (3+17)

Best of Luck