Practice Question SET-1
Algorithm Design 1

**NB: The yellow shaded options are the answers.

Q1.
What is the time complexity of fun()?

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

A. θ (n^2)
B. θ (nLogn)
C. θ (n)
D. θ (n.Logn.Logn)

Q2.

Consider the following three claims

I. $(n + k)^m = \theta (n^m)$, where k and m are constants

II. $2^{(n + 1)} = 0(2^n)$

III. $2^{(2n + 1)} = 0(2^n)$

Which of these claims are correct?

A. I and II

B. I and III

C. II and III

D. I, II and III

Q3.
Heap sort is found to be very efficient

A. in time consumption

B. with regard to storage requirement

C. regarding overheads involved

D. None of the above

Q4.

What is the number of edges present in a complete graph having n vertices?
a) (n*(n+1))/2
b) (n*(n-1))/2
c) n
d) Information given is insufficient

Q5.

Depth First Search is equivalent to which of the traversal in the Binary Trees?
a) Pre-order Traversal
b) Post-order Traversal
c) Level-order Traversal
d) In-order Traversal

Q6.

Which of the following is the most commonly used data structure for implementing Dijkstra's Algorithm?
a) Max priority queue
b) Stack
c) Circular queue
d) Min priority queue

Q7.
In a competition, four different functions are observed. All the functions use a single for loop and within the for loop, same set of statements are executed. If **n** is the size of input(positive), which function is most efficient(if the task to be performed is not an issue)?
A) for(i = 0; i < n; i++)
B) for(i = 0; i < n; i += 2)
C) for(i = 1; i < n; i *= 2)
D) for(i = n; i > -1; i /= 2)

Q8.
A sorting technique is called stable if:

A) It takes O(nlog n)time

B) It maintains the relative order of occurrence of non-distinct elements

C)It uses divide and conquer paradigm
D)It takes O(n) space

Q9.

What is the time complexity of fun()?

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

(A) Θ (n)
(B) Θ (n^2)
(C) Θ (n*logn)
(D) Θ (n*logn*logn)

Q.10.

Which of the following is not O (n^2) ?

A . (15^{10}) * n + 12099
B. $n^{1.98}$
C. n^3 / (sqrt(n))
D. (2^{20}) * n

Q.11.
Which of the given options provides the increasing order of asymptotic complexity of functions f1, f2, f3 and f4?

f1(n) = 2^n

f2(n) = $n^{(3/2)}$

f3(n) = n.logn

f4(n) = $n^{(logn)}$

A. f3, f2,f4,f1
B. f3, f2, f1, f4
C. f2, f3, f1, f4
D. f2, f3, f4, f1

Q. 12.
Heap is defined to be a

A. complete binary tree

B. binary tree

C. tree structure

D. None of the above

Q.13.

Which of the following is an advantage of adjacency list representation over adjacency matrix representation of a graph?

(A) In adjacency list representation, space is saved for sparse graphs.

(B) DFS and BSF can be done in O(V + E) time for adjacency list representation. These operations take O(V^2) time in adjacency matrix representation.

(C) Adding a vertex in adjacency list representation is easier than adjacency matrix representation.

(D) All of the above

Q.14.

The most efficient algorithm for finding the number of connected components in an undirected graph on n vertices and m edges has time complexity.

(A) Θ (n)

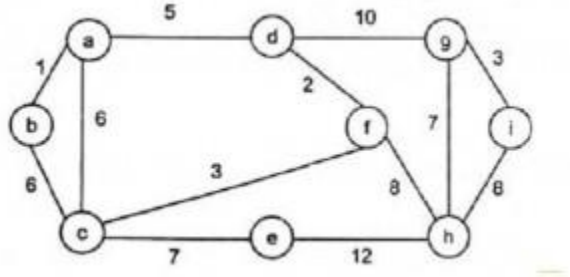
(B) Θ (m)

(C) Θ (m + n)

(D) Θ(m*n)

Q.15.

For the undirected, weighted graph given below, which of the following sequences of edges represents a correct execution of Prim's algorithm to construct a Minimum Spanning Tree?



(A) (a, b), (d, f), (f, c), (g, i), (d, a), (g, h), (c, e), (f, h)

(B) (c, e), (c, f), (f, d), (d, a), (a, b), (g, h), (h, f), (g, i)

(C) (d, f), (f, c), (d, a), (a, b), (c, e), (f, h), (g, h), (g, i)

(D) (h, g), (g, i), (h, f), (f, c), (f, d), (d, a), (a, b), (c, e)

Q.16.

What is the maximum number of edges in an acyclic undirected graph with n vertices?

(A) n-1

(B) n

(C) n + 1

(D) 2n-1

Q.17.

Given pseudo code of Dijkstra's Algorithm.

```
1. //Initialise single source(G,s)
2. S=0
3. Q=V[G]
4. While Q != 0
5.          Do u=extract-min(Q)
6.                    S=S union {u}
7.                    For each vertex v in adj[u]
8.                              Do relax(u,v,w)
```

What happens when while loop in line 4 is changed to while Q>1?

a) While loop gets executed for v times

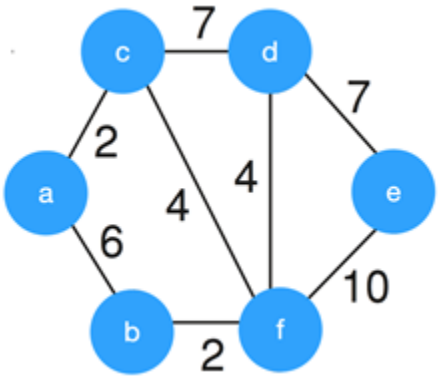
b) While loop gets executed for v-1 times

c) While loop gets executed only once

d) While loop does not get executed

Q.18.

Consider the given graph.



What is the weight of the minimum spanning tree using the Kruskal's algorithm?

a) 24

b) 23

c) 15
d) 19

Q.19.

Which statement(s) is/are true for the graph G.?

a) If G has a topological ordering, then G is a DAG (directed acyclic graph).

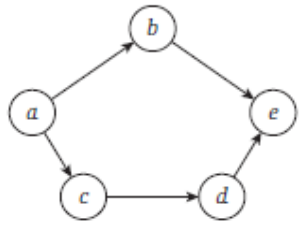
b) If G is a DAG (directed acyclic graph), then G has a topological ordering.

c) Both (a) and (b)

d) None of the above

Q.20.

How many topological orderings does this graph have?



a) 2
b) 3
c) 1
d) 0

*****Best of Luck*****

ALGORITHM DESIGN 1(CSE3131)

Practice Question SET-2

- You are allowed to use only those concepts which are covered in the lecture class till date

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1. Compare the following functions based on asymptotic notations
   $f(n) = \sqrt{n}$ and $g(n) = (\log n)^2$
2. Compare the following functions based on asymptotic notations
   $f(n) = \log(\log n)$ and $g(n) = \sqrt{n}$
3. Compare the following functions based on asymptotic notations
   $f(n) = n^{1.5}$ and $g(n) = n \log n$

4. The total number of comparisons in bubble sort is
   A. (n.logn)
   B . (2n)
   C . (n^2)
   D. None of the above
5. Running time of an algorithm T(n), where n is input size, is given by T(n) = 8T(n/2) + qn, if n > 1 and T(n) = p if n = 1, where p and q are constants. The order of the algorithm is
   A. n^2
   B. n^n
   C. n^3
   D. n
6. An algorithm consists of two modules: x1 and x2. Their orders are f(n) and g(n) respectively. The order of the algorithm is
   A.max [f(n),g(n)]
   B. min [f(n),g(n)]
   C. f(n)+g(n)
   D. f(n)*g(n)
7. Running time T(n) where 'n' is the input size of the recursive algorithm given as : T(n) = c + T(n-1), if n > 1 ; T(n) = d if n < 1. The order of the algorithm is
   A. n^2
   B. n
   C. n^3
   D. n^n
8. Which of the following functions has the largest growth rate?
   A. n^(1/2)
   B. n^100
   C. 2^(n/2)

D. 2^(n!)

9. If we start with node 10 in V_T as the starting node and use Prim's algorithm to construct the minimum spanning tree give the order in which nodes enter V_T. Also, give the minimum total weight.

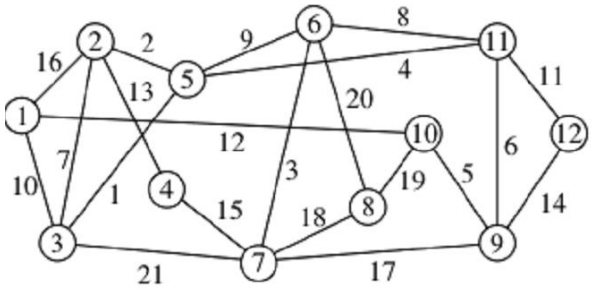


Figure 1: Graph for question 1(e).

Ans: The order is 10, 9, 11, 5, 3, 2, 6, 7, 1, 12, 4, 8. Total weight 81

10. Is the array with values <23, 17, 14, 6, 13, 10, 1, 5, 7, 12> a max-heap? If not then build the max heap. Ans: No. Max Heap = <23,17,14,7,13,10,1,5,6,12>

11. Illustrate the operation of MAX-HEAPIFY (A,3) on the array A =<27, 17,3,16,13,10,1,5,7,12,4,8,9,0>. Ans: <27,17,10,16,13,9,1,5,7,12,4,8,3,0>

12. Let the running time of a recursive algorithm satisfy the recurrence: T (n) = aT (√ n) + h(n). Deduce the running time T (n) in asymptotic Θ notation for the cases:

h(n) = n^d for some d ∈ {1, 2, 3, . . .},

13. Let the running time of a recursive algorithm satisfy the recurrence: T (n) = aT (√ n) + h(n). Deduce the running time T (n) in asymptotic Θ notation for the cases:

h(n) = $\log^d n$ for some d ∈ {0, 1, 2, . . .}

14. Consider an array representation of an n element binary heap where the elements are stored from 1 to index n of the array. For the element stored in index i of the array (i<=n), the index of the parent is

A) A[1] B) (i+1)/2 C) ⌊ i/2 ⌋ D) ⌈ i/2 ⌉ E) None

15. Show the correct matching

I.	MAX-HEAPIFY	a. O(lgn)
II.	BUILD-MAX-HEAP	b. O(n)
III.	HEAP-SORT	c . O(nlgn)
IV.	MAX-HEAP-INSERT	d. O(lgn)
V.	HEAP-EXTRACT-MAX	e. O(lgn)
VI.	HEAP-MAXIMUM	f. O(1)

A) I-a, II-b, III-d, IV-c, V-e, VI-f B) I-a, II-c, III-b, IV-d, V-e, VI-f **C)** I-a, II-b, III-c, IV-d, V-e, VI-f
D) I-c, II-b, III-a, IV-d, V-e, VI-f

16. The following array contains the entire integer up to 13.

13	8	a	b	c	d	5	6	4	1	2	10	9

Write the value of a, b, c and d so that it is a MAX HEAP?

A) a= 12, b=7, c=11, d=3 B) a= 11, b=7, c=3, d=12 C) a= 12, b=7, c=3, d=11 D) a= 7, b=13, c=3, d=11

17. Suppose we are comparing implementation of INSERTION sort and HEAP sort on the same machine. For i/p of size n INSERTION sort runs in $8n^2$ steps, while HEAP sort run in 64nlogn steps. For which values of n does INSERTION sort beat HEAP sort?

A) n<=15 B) n=7 C) n<=5 D) n>0

18. A binary-heap is a nearly complete binary tree with the following properties

I. Heap property
II. Sorting property
III. Structural property
IV. Tree property

A) I and IV B) I and II C) I and III D) I

AD1 Quiz-1

* Required

1. Full Name *

2. Registration No. *

3. Branch *

4. Section *

5. 1.A data structure that follows the FIFO principle. 1 point

Mark only one oval.

- a) Queue
- b) LL
- c) Stack
- d) Union

6. 2. Another name for 1-D arrays. 1 point

Mark only one oval.

- a) Linear arrays
- b) Lists
- c) Horizontal array
- d) Vertical array

7. 3. When an algorithm is written in the form of a programming language, it becomes a _____ 1 point

Mark only one oval.

- a) Flowchart
- b) Program
- c) Pseudo code
- d) Syntax

8. 4. Any algorithm is a program. 1 point

Mark only one oval.

- a) True
- b) False

9. 5. A system wherein items are added from one and removed from the other end. 1 point

Mark only one oval.

- a) Stack
- b) Queue
- c) Linked List
- d) Array

AD1-Quiz 2

* Required

1. Full Name *

2. Registration No. *

3. Branch *

4. Section *

5. 1. An algorithm is a_____set of instructions. 1 point

Mark only one oval.

- infinite
- finite
- definite
- effective

6. 2. Which is the characteristic of an efficient algorithm? 1 point

Mark only one oval.

- Effectiveness
- Definiteness
- Finiteness
- All of the above

7. 3. The computer time consumed by an algorithm during its execution is_____. 1 point

Mark only one oval.

- Time Complexity
- Space Complexity
- Instruction time
- Computer time

8. 4. Which notation gives a tight upper bound? 1 point

Mark only one oval.

- Big 'Oh'
- Big 'Omega'
- Theta
- None of the above

9. 5. Which of the notation gives a tight lower bound? 1 point

Mark only one oval.

- Big 'Oh'
- Big 'Omega'
- Theta
- Small 'Omega'

AD1-Quiz 3

* Required

1. Full Name *

2. Registration No. *

3. Branch *

4. 1. F(n)=3n^2+4n+50 is_____. [Here the symbol ^ represents power of something] 1 point

Mark only one oval.

- O(n^2)
- O(n)
- O(1)
- O(n^3)

5. 2. Steps of Divide and Conquer approach 1 point

Mark only one oval.

- Divide, Combine and Conquer
- Combine, Conquer and Divide
- Combine, Divide and Conquer
- Divide, Conquer and Combine

6. 3.Which searching technique is better when the elements are not sorted? 1 point

Mark only one oval.

- Linear Search
- Binary search
- Heap search
- None

7. 4. Time complexity of Binary search is 1 point

Mark only one oval.

- O(n)
- O(log n)
- O(n*n)
- O(n*log n)

8. 5.In Binary search which one is correct ? 1 point

Mark only one oval.

- mid=(beg + end)/2
- mid=(beg - end)/2
- mid=(beg * end)/2
- mid=(beg + end)

AD1-Quiz 4

* Required

1. Full Name *

2. Registration No. *

3. Section *

4. 1. Which of the given options provides the increasing order of asymptotic complexity of functions f1, f2, f3 and f4? f1(n) = 2^n, f2(n) = n^(3/2), f3(n) = nLogn, f4(n) = n^(Logn) 1 point

Mark only one oval.

- a. f3, f2, f1, f4
- b. f2, f3, f1, f4
- c. f2, f3, f4, f1
- d. f3, f2, f4, f1

5. 2. Division Pattern of Problems in Divide and Conquer approach is 1 point

Mark only one oval.

- a. Iterative
- b. Recursive
- c. Parallel
- d. Random

6. 3. The space factor when determining the efficiency of algorithm is measured by 1 point

Mark only one oval.

- a. Counting the maximum memory needed by the algorithm
- b. Counting the minimum memory needed by the algorithm
- c. Counting the average memory needed by the algorithm
- d. Counting the maximum disk space needed by the algorithm

7. 4. What is the worst case runtime of linear search(recursive) algorithm? 1 point

Mark only one oval.

- a) O(n)
- b) O(logn)
- c) O(n^2)
- d) O(n^x)

8. 5. Finding the location of an element with a given value is: 1 point

Mark only one oval.

- Traversal
- Search
- Sort
- None of the above

AD 1 Quiz-5

* Required

1. Name *

2. Registration No *

3. Section *

4. 1. Master's theorem is used for? 1 point

Mark only one oval.

- solving recurrences
- solving iterative relations
- analysing loops
- calculating the time complexity of any code

5. 2.How many cases are there under Master's theorem? 1 point

Mark only one oval.

- 2
- 3
- 4
- 5

6. 3.We can solve any recurrence by using Master's theorem. 1 point

Mark only one oval.

- ◯ True
- ◯ False

7. 4. What is the solution of the recurrence T(n)=T(n-1)+n ? 1 point

Mark only one oval.

- ◯ Theta(n)
- ◯ Theta(n^2)
- ◯ Theta(log n)
- ◯ Theta(n^3)

8. 5. What is the solution of the recurrence T(n)=T(n/2)+1 ? 1 point

Mark only one oval.

- ◯ Theta(n)
- ◯ Theta(n^2)
- ◯ Theta(log n)
- ◯ Theta(n^3)

AD 1 Quiz-6

* Required

1. Name of the Student *

2. Registration No. *

3. Section *

4. 1. The step(s) in the Divide and conquer process that takes a recursive approach is said to be 1 point

Mark only one oval.

- A. Conquer/Solve
- B. Merge/Combine
- C. Divide/Break
- D. Both B and C

5. 2. The sub-problems in the Divide and conquer process are solved 1 point

Mark only one oval.

- A. Dependently
- B. Independently
- C. Parallel
- D. Concurrent

6. 3. If for an algorithm time complexity is given by O(n) then complexityof it is: 1 point

Mark only one oval.

- A. constant
- B. linear
- C. exponential
- D. none of the mentioned

7. 4. If for an algorithm time complexity is given by O(1) then complexity of it is: 1 point

Mark only one oval.

- A. constant
- B. polynomial
- C. exponential
- D. none of the mentioned

8. 5. The algorithms like merge sort, quick sort and binary search are based on 1 point

Mark only one oval.

- A. Greedy algorithm
- B. Divide and Conquer algorithm
- C. Hash table
- D. Parsing

AD 1 Quiz-7

* Required

1. Full Name *

2. Registration No. *

3. Section *

4. 1. In a max-heap, element with the greatest key is always in the which node? 1 point

Mark only one oval.

- a) Leaf node
- b) First node of left sub tree
- c) root node
- d) First node of right sub tree

5. 2. Heap exhibits the property of a binary tree? 1 point

Mark only one oval.

- a) True
- b) False

6. 3. In a complete binary tree the leaf nodes are present at height h or h-1. 1 point

Mark only one oval.

- a) True
- b) False

7. 4. Heap can be used as _____ 1 point

Mark only one oval.

- a) Priority queue
- b) Stack
- c) A decreasing order array
- d) Normal Array

8. 5. The worst case complexity of deleting any arbitrary node value element from heap is _____ 1 point

Mark only one oval.

- a) O(logn)
- b) O(n)
- c) O(nlogn)
- d) O(n^2)

AD 1 Quiz-8

* Required

1. Name *

2. Registration No. *

3. Section *

4. 1. On which algorithm is heap sort based on? 1 point

Mark only one oval.

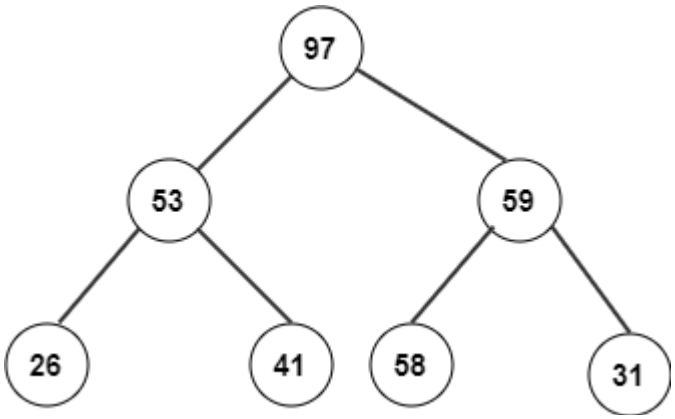
- a) Fibonacci heap
- b) Binary tree
- c) Priority queue
- d) FIFO

5. 2. In what time can a heap be built? 1 point

Mark only one oval.

- a) O(N)
- b) O(N log N)
- c) O(log N)
- d) O(N^2)

6. 3. Consider the following heap after buildheap phase. What will be its corresponding array? 1 point



Mark only one oval.

- a) 26,53,41,97,58,59,31
- b) 26,31,41,53,58,59,97
- c) 26,41,53,97,31,58,59
- d) 97,53,59,26,41,58,31

7. 4. What is the typical running time of a heap sort algorithm? 1 point

Mark only one oval.

- a) O(N)
- b) O(N log N)
- c) O(log N)
- d) O(N^2)

8. 5. What is the time taken to perform a delete min operation? 1 point

Mark only one oval.

- a) O(N)
- b) O(N log N)
- c) O(log N)
- d) O(N^2)

AD 1 Quiz-9

* Required

1. Name *

2. Registration No. *

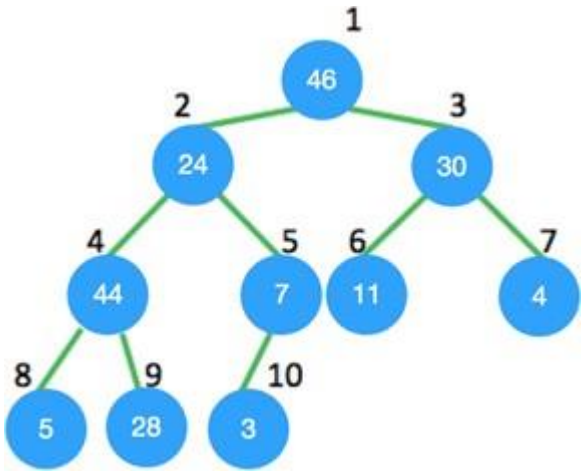
3. Section *

4. 1. Which one of the following is false? 1 point

Mark only one oval.

- a) Heap sort is an in-place algorithm
- b) Heap sort has O(nlogn) average case time complexity
- c) Heap sort is stable sort
- d) Heap sort is a comparison-based sorting algorithm

5. 2. The essential part of Heap sort is construction of max-heap. Consider the tree shown below, the node 24 violates the max-heap property. Once heapify procedure is applied to it, which position will it be in? 1 point



Mark only one oval.

- a) 4
- b) 5
- c) 8
- d) 9

6. 3.Heap sort is a stable algorithm. 0 points

Mark only one oval.

- True
- False

7. 4. A_____is a special Tree-based data structure in which the tree is a complete binary tree.? 1 point

Mark only one oval.

- A. Graph
- B. Heap
- C. List
- D. Stack

8. 5.In which heap the root node must be greatest among the keys present at all of it's children? 1 point

Mark only one oval.

- A. min-heap
- B. max-heap
- C. Both A and B
- D. None of the above

AD 1 Quiz-10

* Required

1. Name *

2. Registration no. *

3. Section *

4. 1. What is an external sorting algorithm? 1 point

Mark only one oval.

- A. Algorithm that uses tape or disk during the sort
- B. Algorithm that uses main memory during the sort
- C. Algorithm that involves swapping
- D. Algorithm that are considered 'in place'

5. 2. Which of the following is not an in-place sorting algorithm? 1 point

Mark only one oval.

- A. Selection sort
- B. Heap sort
- C. Quick sort
- D. Merge sort

6. 3. Which one of the following is not a stable sorting algorithm? 1 point

Mark only one oval.

- A. Insertion sort
- B. Heap sort
- C. Bubble sort
- D. Merge sort

7. 4. Which of the following algorithm does not divide the list – 1 point

Mark only one oval.

- linear search
- binary search
- merge sort
- quick sort

8. 5. How many swaps are required to sort the given array using bubble sort - { 2, 5, 1, 3, 4} ? 1 point

Mark only one oval.

- 4
- 5
- 6
- 7

AD 1 Quiz-11

* Required

1. Name *

2. Registration no. *

3. Section *

4. 1.Graphs are represented using ..... 1 point

Mark only one oval.

- Adjacency tree
- Adjacency linked list
- Adjacency graph
- Adjacency queue

5. 2. Graph traversal is different from a tree traversal, because: 1 point

Mark only one oval.

- trees are not connected
- graphs may have loops
- trees have root
- None of these

6. 3. A tree is a graph. 1 point

Mark only one oval.

- ◯ True
- ◯ False

7. 4. Which of the following is useful in traversing a given graph by breadth first search? 1 point

Mark only one oval.

- ◯ set
- ◯ List
- ◯ stacks
- ◯ Queue

8. 5. The DFS tree of a connected graph with 10 vertices contains ..... 1 point

Mark only one oval.

- ◯ 9 edges
- ◯ 11 edges
- ◯ 10 edges
- ◯ 9 vertices

AD1 Quiz-12

* Required

1. Name *

2. Regd. no. *

3. Section *

4. 1. For a given graph G having v vertices and e edges which is connected and has no cycles, which of the following statements is true? 1 point

Mark only one oval.

- a) v=e
- b) v = e+1
- c) v + 1 = e
- d) v = e-1

5. 2. Which of the following is true? 1 point

Mark only one oval.

- a) A graph may contain no edges and many vertices
- b) A graph may contain many edges and no vertices
- c) A graph may contain no edges and no vertices
- d) A graph may contain no vertices and many edges

6. 3. Which of the following ways can be used to represent a graph? 1 point

Mark only one oval.

- a) Adjacency List and Adjacency Matrix
- b) Incidence Matrix
- c) Adjacency List, Adjacency Matrix as well as Incidence Matrix
- d) No way to represent

7. 4. What is the number of edges present in a complete graph having n vertices? 1 point

Mark only one oval.

- a) (n*(n+1))/2
- b) (n*(n-1))/2
- c) n
- d) Information given is insufficient

8. 5.Time Complexity of Breadth First Search is? (V – number of vertices, E – number of edges) 1 point

Mark only one oval.

- a) O(V + E)
- b) O(V)
- c) O(E)
- d) O(V*E)

AD1 Quiz-13

* Required

1. Name *

_____

2. Registration No. *

_____

3. Section *

_____

4. 1.Which of the following is false in the case of a spanning tree of a graph G? 1 point

Mark only one oval.

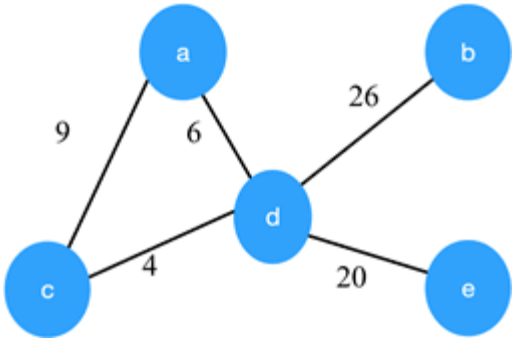
- a) It is tree that spans G
- b) It is a subgraph of the G
- c) It includes every vertex of the G
- d) It can be either cyclic or acyclic

5. 2. Every graph has only one minimum spanning tree. 1 point

Mark only one oval.

- a) True
- b) False

6. 3. Consider the graph shown below. Which of the following are the edges in the MST of the given graph? 1 point



Mark only one oval.

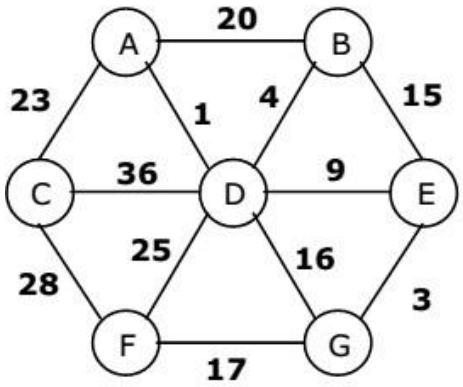
- a) (a-c)(c-d)(d-b)(d-b)
- b) (c-a)(a-d)(d-b)(d-e)
- c) (a-d)(d-c)(d-b)(d-e)
- d) (c-a)(a-d)(d-c)(d-b)(d-e)

7. 4. What is the cost of the MST generated from Graph given in Q.3. 1 point

Mark only one oval.

- a) 61
- b) 59
- c) 56
- d) 39

8. 5. For the graph below, the Depth First Spanning tree visiting sequence from vertex A is: 1 point



Node	Adjacency List
A	B C D
B	A D E
C	A D F
D	A B C E F G
E	B D G
F	C D G
G	F D E

Mark only one oval.

- a) A B C D E F G
- b) A B D C F G E
- c) A B C F E D G
- d) None of the above

Find c1, c2, n0 such that the figure below is true. Show the full derivation in the file you upload.

$$\frac{1}{2}n^2 - 3n = \Theta(n^2).$$

Add file

Which asymptotic notation is this true for? 1 point

$$\lim_{n\to\infty} \frac{f(n)}{g(n)} = 0 .$$

- little oh
- little omega
- big oh
- big omega

Which asymptotic notation is this true for? 1 point

$$\lim_{n \to \infty} \frac{f(n)}{g(n)} = \infty$$

- ○ little oh
- ○ little omega
- ○ big oh
- ○ big omega

Is an array that is in sorted order a min-heap? 1 point

Choose YES

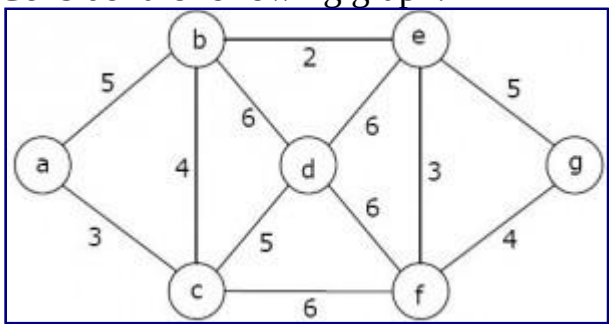
Where in a max-heap might the smallest element reside, assuming that all elements are distinct? 1 point

- Anywhere
- As one of the 1st level nodes
- One of the leaves
- Cannot be determined

1. To implement Dijkstra's shortest path algorithm on unweighted graphs so that it runs in linear time, the data structure to be used is**:**

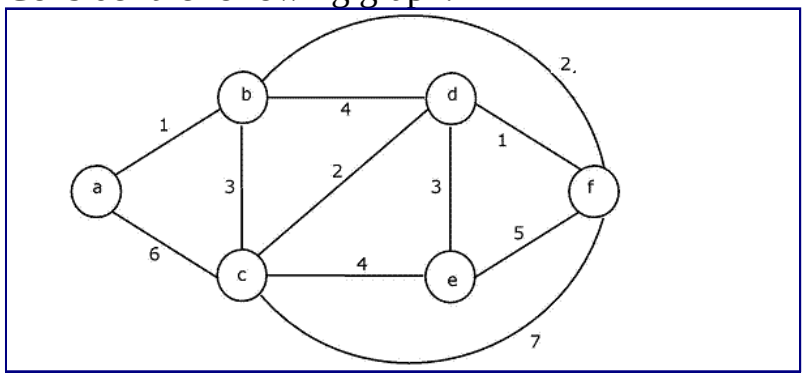
(A) Priority Queue
(B) Stack
(C) Heap
(D) B-Tree

2. Consider the following graph:



Which one of the following is NOT the sequence of edges added to the minimum spanning tree using Kruskal's algorithm?
(A) (b,e)(e,f)(a,c)(b,c)(f,g)(c,d)
(B) (b,e)(e,f)(a,c)(f,g)(b,c)(c,d)
(C) (b,e)(a,c)(e,f)(b,c)(f,g)(c,d)
(D) (b,e)(e,f)(b,c)(a,c)(f,g)(c,d)

3. Consider the following graph:



Which one of the following cannot be the sequence of edges added, in that order, to a minimum spanning tree using Kruskal's algorithm?
(A) (a—b),(d—f),(b—f),(d—c),(d—e)
(B) (a—b),(d—f),(d—c),(b—f),(d—e)
(C) (d—f),(a—b),(d—c),(b—f),(d—e)
(D) (d—f),(a—b),(b—f),(d—e),(d—c)

4. In an adjacency list representation of an undirected simple graph G = (V, E), each edge (u, v) has two adjacency list entries: [v] in the adjacency list of u, and [u] in

the adjacency list of v. These are called twins of each other. A twin pointer is a pointer from an adjacency list entry to its twin. If |E| = m and |V | = n, and the memory size is not a constraint, what is the time complexity of the most efficient algorithm to set the twin pointer in each entry in each adjacency list?

(A) Θ(n2)
(B) Θ(m+n)
(C) Θ(m2)
(D) Θ(n4)

5. Let G be an undirected graph. Consider a depth-first traversal of G, and let T be the resulting depth-first search tree. Let u be a vertex in G and let v be the first new (unvisited) vertex visited after visiting u in the traversal. Which of the following statements is always true?

(A) {u,v} must be an edge in G, and u is a descendant of v in T
(B) {u,v} must be an edge in G, and v is a descendant of u in T
(C) If {u,v} is not an edge in G then u is a leaf in T
(D) If {u,v} is not an edge in G then u and v must have the same parent in T

6. What are the appropriate data structures for following algorithms?
(1) Breadth First Search
(2) Depth First Search
(3) Prim's Minimum Spanning Tree
(4) Kruskal' Minimum Spanning Tree

(A)
1) Stack
2) Linear Queue
3) Priority Queue
4) Union Find
(B)
1) Linear Queue
2) Stack
3) Priority Queue
4) Union Find
(C)
1) Stack
2) Linear Queue
3) Union Find
4) Priority Queue
(D)
1) Priority Queue
2) Linear Queue
3) Stack
4) Union Find

7. Which is the correct order of the following algorithms with respect to their time Complexity in the best case ?
(A) Merge sort > Quick sort >Insertion sort > selection sort
(B) insertion sort < Quick sort < Merge sort < selection sort
(C) Merge sort > selection sort > quick sort > insertion sort
(D) Merge sort > Quick sort > selection sort > insertion sort

8. You have to sort 1 GB of data with only 100 MB of available main memory. Which sorting technique will be most appropriate?
(A) Heap sort
(B) Merge sort
(C) Quick sort
(D) Insertion sort

9. Assume that a merge sort algorithm in the worst case takes 30 seconds for an input of size 64. Which of the following most closely approximates the maximum input size of a problem that can be solved in 6 minutes?
(A) 256
(B) 512
(C) 1024
(D) 2048

Answer: (B)
Explanation:
Time complexity of merge sort is Θ(nLogn)c*64Log64 is 30
c*64*6 is 30
c is 5/64
For time 6 minutes

5/64*nLogn = 6*60
nLogn = 72*64 = 512 * 9
n = 512.

10. Consider a situation where swap operation is very costly. Which of the following sorting algorithms should be preferred so that the number of swap operations are minimized in general?
(A) Heap Sort
(B) Selection Sort
(C) Insertion Sort
(D) Merge Sort

11. Where in a max-heap can the smallest element reside, assuming all elements are distinct? Include both the location in the array and the location in the implicit tree structure.

12. The sequence 20,15,18,7,9,5,12,3,6,2 is a max-heap. True or False. Explain.

13. ..... sorting algorithm is frequently used when n is small where n is total number of elements.

A. Heap
B. Insertion
C. Bubble
D. Quick

14. Which of the following sorting algorithm is of divide and conquer type?

A. Bubble sort
B. Insertion sort
C. Merge sort
D. Selection sort

15. Topological sort can be implemented by?
a) Using Depth First Search
b) Using Breadth First Search
c) Using Depth and Breadth First Search
d) Using level ordered search

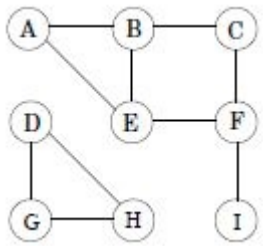
16. Topological sort can be applied to which of the following graphs?
a) Undirected Cyclic Graphs
b) Directed Cyclic Graphs
c) Undirected Acyclic Graphs
d) Directed Acyclic Graphs

17. Which of the following is not an application of Depth First Search?
a) For generating topological sort of a graph
b) For generating Strongly Connected Components of a directed graph
c) Detecting cycles in the graph
d) Peer to Peer Networks

18. Regarding implementation of Depth First Search using stacks, what is the maximum distance between two nodes present in the stack? (considering each edge length 1)
a) Can be anything
b) 0
c) At most 1
d) Insufficient Information

19. Can DFS algorithm be used to check the bipartite-ness of a graph? If yes, how?

20. Perform a depth-first search on the following graph; whenever there's a choice of vertices, pick the one that is alphabetically first. Classify each edge as a tree edge or back edge, and give the pre and post number of each vertex.



21.Which of the following is false?

(A)Heap sort is in-place Algorithm

(B)Heap sort is a stable sort

(C) Heap sort is a comparison-based algorithm

(D)Time complexity of Heap sort is O(nlogn) Average case

22. A _____ is a special Tree-based data structure in which the tree is a complete binary tree.?

A. Graph

B. Heap

C. List

D. Stack

23. Which one of the following array elements represents a binary min heap?

A. 12 10 8 25 14 17

B. 8 10 12 25 14 17

C. 25 17 14 12 10 8

D. 14 17 25 10 12 8

24. Given an array of element 5, 7, 9, 1, 3, 10, 8, 4. Which of the following is the correct sequences of elements after inserting all the elements in a min-heap?

A. 1,3,4,5,7,8,9,10

B. 1,4,3,9,8,5,7,10

C. 1,3,4,5,8,7,9,10

D. 1,3,7,4,8,5,9,10

25. Which one of the following array elements represents a binary min heap?

A. 12 10 8 25 14 17

B. 8 10 12 25 14 17

C. 25 17 14 12 10 8

D. 14 17 25 10 12 8

Branch and Sec *

CSE-J

1. Time Complexity of Breadth First Search is? (V – number of vertices, E – number of edges) * 1/1

- [x] O(V + E)
- [ ] O(V)
- [ ] O(E)
- [ ] O(V*E)

2. The Data structure used in standard implementation of Breadth First Search is? * 1/1

- [ ] Stack
- [x] Queue
- [ ] Linked List
- [ ] Tree

3. The Breadth First Search traversal of a graph will result into? * 1/1

- [ ] Linked List
- [x] Tree
- [ ] Graph with back edges
- [ ] Arrays

4. 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? * 1/1

- [ ] Depth First Search
- [x] Breadth First Search
- [ ] Trim's algorithm
- [ ] Kruskal's algorithm

5. Which of the following is not an application of Breadth First Search? * 1/1

- [ ] Finding shortest path between two nodes
- [ ] Finding bipartiteness of a graph
- [ ] GPS navigation system
- [x] Path Finding

6. The Data structure used in standard implementation of Depth First Search is? * 1/1

- [x] Stack
- [ ] Queue
- [ ] Linked List
- [ ] Tree

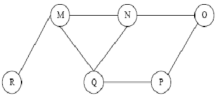
7. Time Complexity of DFS is? (V – number of vertices, E – number of edges) * 1/1

- [x] O(V + E)
- [ ] O(V)
- [ ] O(E)
- [ ] O(V*E)

8. Which of the following algorithms can be used to most efficiently determine the presence of a cycle in a given graph ? * 1/1

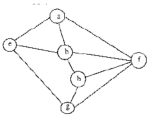
- [x] Depth First Search
- [ ] Breadth First Search
- [ ] Prim's Minimum Spanning Tree Algorithm
- [ ] Kruskal' Minimum Spanning Tree Algorithm

9. One possible order of visiting the nodes of the following graph using BFS is * 1/1



- [ ] MNOPQR
- [ ] NQMPOR
- [x] QMNPRO
- [ ] QMNPOR

10. Among the following sequences: Which are depth first traversals of the below graph? (I) a b e g h f (II) a b f e h g (III) a b f h g e (IV) a f g h b e * 1/1



- [ ] I, II and IV only
- [ ] I and IV only
- [ ] II, III and IV only
- [x] I, III and IV only

✓ 1. What is the number of edges present in a complete graph having n vertices? * 1/1

- (n*(n+1))/2
- (n*(n-1))/2 ✓
- n
- n-1

✓ 2. A graph with all vertices having equal degree is known as a _____ * 1/1

- Multi Graph
- Regular Graph ✓
- Simple Graph
- Complete Graph

✓ 3. Every tree is a graph but every graph is not a tree always. * 1/1

- True ✓
- False

✓ 4. A simple graph should not contain_____ * 1/1

- Self loop
- Multi edges
- both self loop and multi edges ✓
- None of the above

✓ 5. Consider an unweighted undirected graph with n vertices(no self loop and multi edges). What is the minimum number of bits required to represent the graph with adjacency matrix representation. * 1/1

- n*n
- (n*(n+1))/2
- (n*(n-1))/2 ✓
- n-1

✓ 6. In adjacency list representation of graph G=(V,E), the memory space required is _____ * 1/1

- O(V^2)
- O(V+E) ✓
- O(E^2)
- O(V*E)

✓ 7. In _____ graph , indegree and outdegree of any vertex is associated. * 1/1

- undirected
- directed ✓
- both directed and undirected
- None of the above

✓ 8. Which of the following ways can be used to represent a graph? * 1/1

- Adjacency List and Adjacency Matrix
- Incidence Matrix
- Adjacency List, Adjacency Matrix as well as Incidence Matrix ✓
- No way to represent

✓ 9. Adjacency matrix of all graphs are symmetric. * 1/1

- True
- False ✓

✓ 10.For the adjacency matrix of a directed graph the row sum is the _____ degree and the column sum is the _____ degree. * 1/1

- in, out
- out, in ✓
- in, total
- total, out

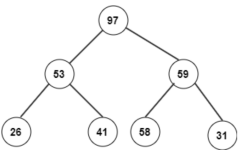
✓ 1. In what time can a binary heap be built? * 1/1

- (●) O(N) ✓
- ( ) O(N^2 log N)
- ( ) O(log N)
- ( ) O(N^2)

✓ 2. Heap sort is faster than Bubble sort. * 1/1

- (●) True ✓
- ( ) False

✓ 3. Consider the following heap after build heap phase. What will be its corresponding array? * 1/1



- ( ) 26,53,41,97,58,59,31
- ( ) 26,31,41,53,58,59,97
- ( ) 26,41,53,97,31,58,59
- (●) 97,53,59,26,41,58,31 ✓

✓ 4. Heap constructed in Q-3 is max-heap? * 1/1

- (●) true ✓
- ( ) False

✓ 5. What is the typical running time of a heap sort algorithm? * 1/1

- ( ) O(N)
- (●) O(N log N) ✓
- ( ) O(log N)
- ( ) O(N^2)

✓ 6. Binary heap is a ---------- * 1/1

- ( ) simple binary tree
- (●) nearly complete binary tree ✓
- ( ) always perfect binary tree
- ( ) always full binary tree

✓ 7. What is maximum and minimum number of nodes in a heap of height h? * 1/1

- ( ) h and h-1
- (●) 2^(h+1)-1and 2^h ✓
- ( ) 2^h and 2^(h+1)
- ( ) h^2 and h^2 +1

✓ 8. What is the height of a heap with n nodes? * 1/1

- ( ) O(n)
- ( ) O(n lg n)
- (●) O(lg n) ✓
- ( ) O(n^2)

✓ 9. A 3-array max heap is like a binary heap but instead of 2-children node are having 3-children. Which of the following is a valid sequence of element in 3-array max heap. * 1/1

- ( ) 1,3,5,6,8,9
- ( ) 9,6,3,1,8,5
- ( ) 9,3,6,8,5,1
- (●) 9,5,6,8,3,1 ✓

✓ 10. Suppose the element 7,2,10,4 are inserted in that order into valid 3-array max heap found in above problem which one of the following is representation of a tree. * 1/1

- (●) 10,7,9,8,3,1,5,2,6,4 ✓
- ( ) 10,9,8,7,6,5,4,3,2,1
- ( ) 10,9,4,5,7,6,8,2,1,3
- ( ) 10,6,8,9,7,2,3,4,1,5

AD1 Quiz

Total points 10/10

✓ Consider an undirected random graph of eight vertices. The probability that there is an edge between a pair of vertices is 1/2. What is the expected number of unordered cycles of length three? 1/1

- ○ 1/8
- ○ 1
- ◉ 7 ✓
- ○ 8

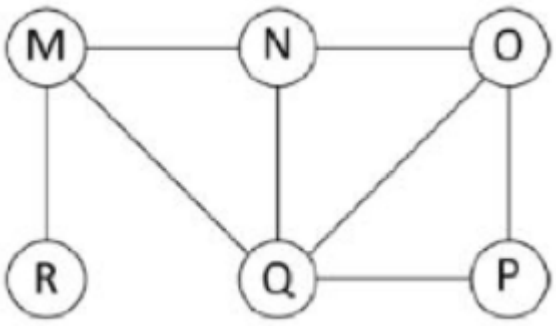
✓ If G is a forest with n vertices and k connected components, how many edges does G have? 1/1

- ○ floor(n/k)
- ○ ceil(n/k)
- ◉ n-k ✓
- ○ n-k+1

✓ Consider a weighted undirected graph with positive edge weights and let uv be an edge in the graph. It is known that the shortest path from the source vertex s to u has weight 53 and the shortest path from s to v has weight 65. Which one of the following statements is always true? 1/1

- weight (u, v) < 12
- weight (u, v) ≤ 12
- weight (u, v) > 12
- (●) weight (u, v) ≥ 12 ✓

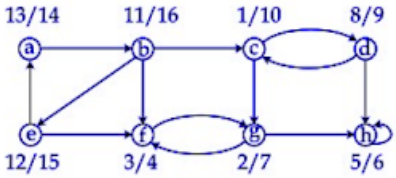
✓ The Breadth First search (BFS) algorithm has been implemented using the queue data structure. Which one of the following is a possible order of visiting the nodes in the graph below? 1/1



- MNOPQR
- NQMPOR
- QMNROP
- (●) POQNMR ✓

✓ Solve : 1/1

In the following graph, discovery time stamps and finishing time stamps of Depth First Search (DFS) are shown as x/y, where x is discovery time stamp and y is finishing time stamp.



It shows which of the following depth first forest?

- (●) {a, b, e}, {c, d, f, g, h} ✓
- ( ) {a, b, e}, {c, d}, {f, g, h}
- ( ) {a, b, e}, {f, g}, {c, d}, {h}
- ( ) none

✓ Suppose we are sorting an array of eight integers using heapsort, and we have just finished some heapify (either maxheapify or minheapify) operations. The array now looks like this: 16 14 15 10 12 27 28 How many heapify operations have been performed on root of heap? 1/1

- ( ) 1
- (●) 2 ✓
- ( ) 3 or 4
- ( ) 5 or 6

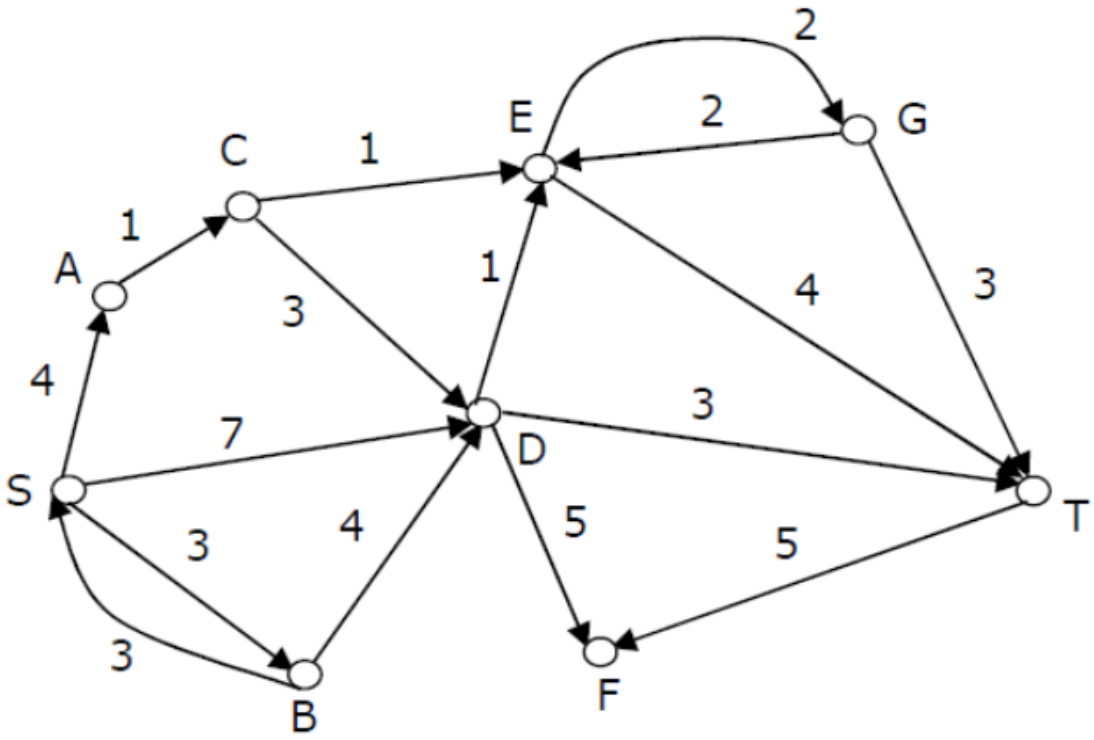
✓ A 3-ary max heap is like a binary max heap, but instead of 2 children, nodes have 3 children. A 3-ary heap can be represented by an array as follows: The root is stored in the first location, a[0], nodes in the next level, from left to right, is stored from a[1] to a[3]. The nodes from the second level of the tree from left to right are stored from a[4] location onward. An item x can be inserted into a 3-ary heap containing n items by placing x in the location a[n] and pushing it up the tree to satisfy the heap property. Which one of the following is a valid sequence of elements in an array representing 3-ary max heap? 1/1

- ○ 1, 3, 5, 6, 8, 9
- ○ 9, 6, 3, 1, 8, 5
- ○ 9, 3, 6, 8, 5, 1
- ◉ 9, 5, 6, 8, 3, 1 ✓

✓ Consider the problem of computing min-max in an unsorted array where min and max are minimum and maximum elements of array. Algorithm A1 can compute min-max in a1 comparisons without divide and conquer. Algorithm A2 can compute min-max in a2 comparisons by scanning the array linearly. What could be the relation between a1 and a2 considering the worst case scenarios? 1/1

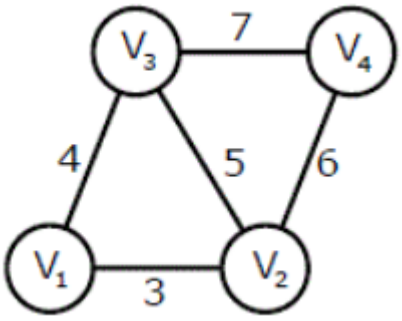
- ○ a1 < a2
- ◉ a1 > a2 ✓
- ○ a1 = a2
- ○ Depends on the input

✓ Consider the directed graph shown in the figure below. There are multiple shortest paths between vertices S and T. Which one will be reported by Dijkstra's shortest path algorithm? Assume that, in any iteration, the shortest path to a vertex v is updated only when a strictly shorter path to v is discovered. 1/1



- ○ SDT
- ○ SBDT
- ○ SACDT
- ◉ SACET ✓

✓ An undirected graph G(V, E) contains n (n > 2) nodes named v1 , v2 ,....vn. 1/1
Two nodes vi , vj are connected if and only if 0 < |i – j| <= 2. Each edge (vi, vj) is assigned a weight i + j. A sample graph with n = 4 is shown below. What will be the cost of the minimum spanning tree (MST) of such a graph with n nodes?



- 1/12(11n^2 – 5n)
- (●) n^2 – n + 1 ✓
- 6n - 11
- 2n + 1

AD1 Quiz

Total points 15/15

✓ Which of the following algorithms can be used to most efficiently determine the presence of a cycle in a given graph ? 1/1

- (●) Depth First Search ✓
- ( ) Breadth First Search
- ( ) Prim's Minimum Spanning Tree Algorithm
- ( ) Kruskal' Minimum Spanning Tree Algorithm

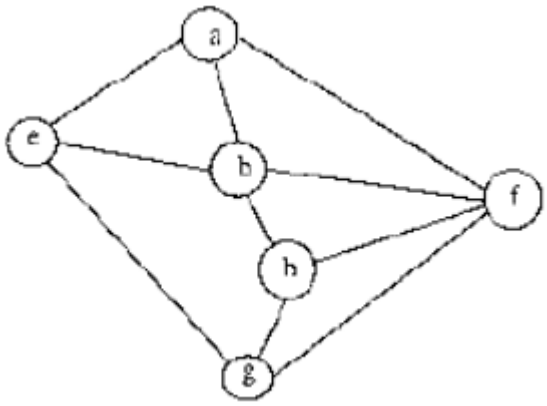
✓ Traversal of a graph is different from tree because 1/1

- (●) There can be a loop in graph so we must maintain a visited flag for every vertex ✓
- ( ) DFS of a graph uses stack, but inorder traversal of a tree is recursive
- ( ) BFS of a graph uses queue, but a time efficient BFS of a tree is recursive.
- ( ) All of the above

✓ Let G be an undirected graph. Consider a depth-first traversal of G, and let T be the resulting depth-first search tree. Let u be a vertex in G and let v be the first new (unvisited) vertex visited after visiting u in the traversal. Which of the following statements is always true? 1/1

- {u,v} must be an edge in G, and u is a descendant of v in T
- {u,v} must be an edge in G, and v is a descendant of u in T
- (●) If {u,v} is not an edge in G then u is a leaf in T ✓
- If {u,v} is not an edge in G then u and v must have the same parent in T

✓ Among the following sequences:(I) a b e g h f (II) a b f e h g(III) a b f h g e (IV) a f g h b e , which are depth first traversals of this graph? 1/1



- I, II and IV only
- I and IV only
- II, III and IV only
- (●) I, III and IV only ✓

✓ Make is a utility that automatically builds executable programs and libraries from source code by reading files called makefiles which specify how to derive the target program. Which of the following standard graph algorithms is used by Make. 1/1

- ○ Strongly Connected Components
- ◉ Topological Sorting ✓
- ○ Breadth First Search
- ○ Dijkstra's Shortest Path

✓ Which of the following condition is sufficient to detect cycle in a directed graph? 1/1

- ○ There is an edge from currently being visited node to an already visited node.
- ◉ There is an edge from currently being visited node to an ancestor of currently visited node in DFS forest. ✓
- ○ Every node is seen twice in DFS.
- ○ None of the above

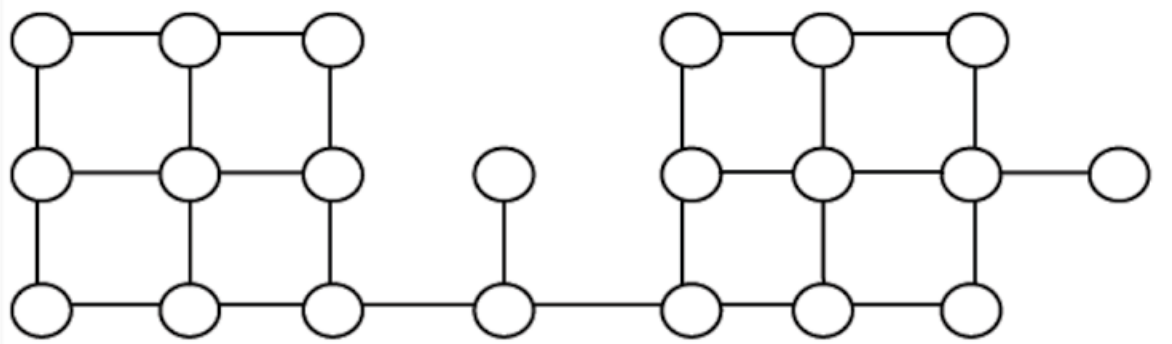
✓ Is following statement true/false If a DFS of a directed graph contains a back edge, any other DFS of the same graph will also contain at least one back edge? 1/1

- ◉ True ✓
- ○ False

✓ Is following statement true/false? A DFS of a directed graph always produces the same number of tree edges, i.e., independent of the order in which vertices are considered for DFS. 1/1

- ○ True
- ◉ False ✓

✓ Suppose depth first search is executed on the graph below starting at some unknown vertex. Assume that a recursive call to visit a vertex is made only after first checking that the vertex has not been visited earlier. Then the maximum possible recursion depth (including the initial call) is 1/1



- ○ 17
- ○ 18
- ◉ 19 ✓
- ○ 20

✓ Let T be a depth first search tree in an undirected graph G. Vertices u and n are leaves of this tree T. The degrees of both u and n in G are at least 2. which one of the following statements is true? 1/1

- ○ There must exist a vertex w adjacent to both u and n in G
- ○ There must exist a vertex w whose removal disconnects u and n in G
- ○ There must exist a cycle in G containing u and n
- ◉ There must exist a cycle in G containing u and all its neighbors in G ✓

✓ In an adjacency list representation of an undirected simple graph G = (V, E), each edge (u, v) has two adjacency list entries: [v] in the adjacency list of u, and [u] in the adjacency list of v. These are called twins of each other. A twin pointer is a pointer from an adjacency list entry to its twin. If |E| = m and |V | = n, and the memory size is not a constraint, what is the time complexity of the most efficient algorithm to set the twin pointer in each entry in each adjacency list? 1/1

- ○ Θ(n^2)
- ◉ Θ(m+n) ✓
- ○ Θ(m^2)
- ○ Θ(n^4)

✓ Let G = (V, G) be a weighted undirected graph and let T be a Minimum Spanning Tree (MST) of G maintained using adjacency lists. Suppose a new weighed edge (u, v) ∈ V×V is added to G. The worst case time complexity of determining if T is still an MST of the resultant graph is 1/1

- Θ(|E| + |V|)
- Θ(|E|.|V|)
- Θ(E| log |V|)
- (•) Θ(|V|) ✓

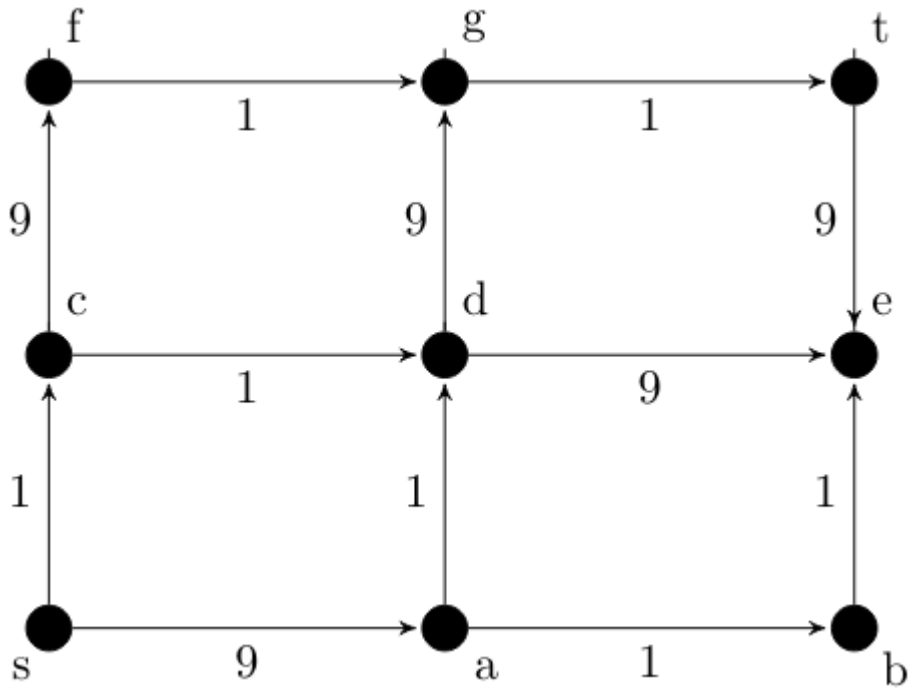
✓ An articulation point in a connected graph is a vertex such that removing the vertex and its incident edges disconnects the graph into two or more connected components. Let T be a DFS tree obtained by doing DFS in a connected undirected graph G. Which of the following options is/are correct? 1/1

- Root of T can never be an articulation point in G.
- (•) Root of T is an articulation point in G if and only if it has 2 or more children. ✓
- A leaf of T can be an articulation point in G.
- If u is an articulation point in G such that x is an ancestor of u in T and y is a descendent of u in T, then all paths from x to y in G must pass through u. ✓

✓ Consider a complete binary tree with 7 nodes. Let A denote the set of first 3 elements obtained by performing Breadth-First Search (BFS) starting from the root. Let B denote the set of first 3 elements obtained by performing Depth-First Search (DFS) starting from the root. The value of |A−B| is 1/1

- (●) 1 ✓
- ( ) 3
- ( ) 4
- ( ) 2

✓ In a directed acyclic graph with a source vertex s, the quality-score of a directed path is defined to be the product of the weights of the edges on the path. Further, for a vertex v other than s, the quality-score of v is defined to be the maximum among the quality-scores of all the paths from s to v. The quality-score of s is assumed to be 1. The sum of the quality-scores of all vertices on the graph shown above is ? 1/1



- (●) 929 ✓
- ( ) 81
- ( ) 729
- ( ) 1023

AD1 Quiz

Total points 21/21

Email *

✓ What is recurrence for worst case of QuickSort and what is the time complexity in Worst case? 1/1

- ( ) Recurrence is T(n) = T(n-2) + O(n) and time complexity is O(n^2)
- (•) Recurrence is T(n) = T(n-1) + O(n) and time complexity is O(n^2) ✓
- ( ) Recurrence is T(n) = 2T(n/2) + O(n) and time complexity is O(nLogn)
- ( ) Recurrence is T(n) = T(n/10) + T(9n/10) + O(n) and time complexity is O(nLogn)

✓ Suppose we have a O(n) time algorithm that finds median of an unsorted array. Now consider a QuickSort implementation where we first find median using the above algorithm, then use median as pivot. What will be the worst case time complexity of this modified QuickSort. 1/1

- ( ) O(n^2 Logn)
- ( ) O(n^2)
- ( ) O(n Logn Logn)
- (•) O(nLogn) ✓

✓ Which of the following is not a stable sorting algorithm in its typical implementation. 1/1

- ○ Insertion Sort
- ○ Merge Sort
- ◉ Quick Sort ✓
- ○ Bubble Sort

✓ Which of the following sorting algorithms in its typical implementation gives best performance when applied on an array which is sorted or almost sorted (maximum 1 or two elements are misplaced). 1/1

- ○ Quick Sort
- ◉ Insertion sort ✓
- ○ Heap Sort
- ○ Merge sort

✓ Given an unsorted array. The array has this property that every element in array is at most k distance from its position in sorted array where k is a positive integer smaller than size of array. Which sorting algorithm can be easily modified for sorting this array and what is the obtainable time complexity? 1/1

- ○ Insertion Sort with time complexity O(kn)
- ◉ Heap Sort with time complexity O(nLogk) ✓
- ○ Quick Sort with time complexity O(kLogk)
- ○ Merge Sort with time complexity O(kLogk)

✓ Consider a situation where swap operation is very costly. Which of the following sorting algorithms should be preferred so that the number of swap operations are minimized in general? 1/1

- ○ Heap Sort
- ◉ Selection Sort ✓
- ○ Insertion Sort
- ○ Merge Sort

✓ Which of the following is not true about comparison based sorting algorithms? 1/1

- ○ The minimum possible time complexity of a comparison based sorting algorithm is O(nLogn) for a random input array
- ○ Any comparison based sorting algorithm can be made stable by using position as a criteria when two elements are compared
- ○ Counting Sort is not a comparison based sorting algorithm
- ◉ Heap Sort is not a comparison based sorting algorithm. ✓

✓ Suppose we are sorting an array of eight integers using quicksort, and we have just finished the first partitioning with the array looking like this: 2 5 1 7 9 12 11 10 1/1

- ◉ The pivot could be either the 7 or the 9. ✓
- ○ The pivot could be the 7, but it is not the 9
- ○ The pivot is not the 7, but it could be the 9
- ○ Neither the 7 nor the 9 is the pivot.

✓ What is the best time complexity of bubble sort? 1/1

- ○ N^2
- ○ NlogN
- ◉ N ✓
- ○ N(logN)^2

✓ You have to sort 1 GB of data with only 100 MB of available main memory. Which sorting technique will be most appropriate? 1/1

- ○ Heap sort
- ◉ Merge sort ✓
- ○ Quick sort
- ○ Insertion sort

✓ What is the worst case time complexity of insertion sort where position of the data to be inserted is calculated using binary search? 1/1

- ○ N
- ○ NlogN
- ◉ N^2 ✓
- ○ N(logN)^2

✓ The tightest lower bound on the number of comparisons, in the worst case, for comparison-based sorting is of the order of 1/1

- ○ N
- ○ N^2
- ◉ NlogN ✓
- ○ N(logN)^2

✓ In a modified merge sort, the input array is splitted at a position one-third of the length(N) of the array. Which of the following is the tightest upper bound on time complexity of this modified Merge Sort. 1/1

- ○ N(logN base 3)
- ○ N(logN base 2/3)
- ○ N(logN base 1/3)
- ◉ N(logN base 3/2) ✓

✓ Which sorting algorithm will take least time when all elements of input array are identical? Consider typical implementations of sorting algorithms. 1/1

- ◉ Insertion sort ✓
- ○ Heap sort
- ○ Merge sort
- ○ Selection sort

✓ A list of n string, each of length n, is sorted into lexicographic order using the merge-sort algorithm. The worst case running time of this computation is 1/1

- ○ O (n log n)
- ◉ O (n^2 log n) ✓
- ○ O (n^2 + log n)
- ○ O (n^2)

✓ In quick sort, for sorting n elements, the (n/4)th smallest element is selected as pivot using an O(n) time algorithm. What is the worst case time complexity of the quick sort? 1/1

- ○ \theta(n)
- ◉ \theta(nLogn) ✓
- ○ \theta(n^2)
- ○ \theta(n^2 log n)

✓ Consider the Quicksort algorithm. Suppose there is a procedure for finding a pivot element which splits the list into two sub-lists each of which contains at least one-fifth of the elements. Let T(n) be the number of comparisons required to sort n elements. Then 1/1

- ○ T(n) <= 2T(n/5) + n
- ◉ T(n) <= T(n/5) + T(4n/5) + n ✓
- ○ T(n) <= 2T(4n/5) + n
- ○ T(n) <= 2T(n/2) + n

✓ Which of the following sorting algorithms has the lowest worst-case complexity? 1/1

- ◉ Merge sort ✓
- ○ Bubble sort
- ○ Quick sort
- ○ Selection sort

✓ Which sorting algorithms is most efficient to sort string consisting of ASCII characters? 1/1

- ○ Quick sort
- ○ Heap sort
- ○ Merge sort
- ◉ Counting sort ✓

✓ The number of elements that can be sorted in \Theta(logn) time using heap sort is 1/1

- ○ \Theta(1)
- ○ \Theta(\sqrt{logn})
- ◉ \Theta(Log n/(Log Log n)) ✓
- ○ \Theta(Log n)

✓ Which of the following is true about merge sort? 1/1

- ○ Merge Sort works better than quick sort if data is accessed from slow sequential memory.
- ○ Merge Sort is stable sort by nature
- ○ Merge sort outperforms heap sort in most of the practical situations.
- ◉ All of the above ✓

AD1 Quiz

Total points 27/28

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✓ Q1. In quick sort, for sorting n elements, the (n/4)th smallest element is selected as pivot using an O(n) time algorithm. What is the worst case time complexity of the quick sort? 1/1

- ○ theta(n)
- ◉ theta(nLogn) ✓
- ○ theta(n^2)
- ○ theta(n^2 log n)

✓ Q2. Consider the Quicksort algorithm. Suppose there is a procedure for finding a pivot element which splits the list into two sub-lists each of which contains at least one-fifth of the elements. Let T(n) be the number of comparisons required to sort n elements. Then 1/1

- ○ T(n) <= 2T(n/5) + n
- ◉ T(n) <= T(n/5) + T(4n/5) + n ✓
- ○ T(n) <= 2T(4n/5) + n
- ○ T(n) <= 2T(n/2) + n

✓ Q3. Let P be a QuickSort Program to sort numbers in ascending order using the first element as pivot. Let t1 and t2 be the number of comparisons made by P for the inputs {1, 2, 3, 4, 5} and {4, 1, 5, 3, 2} respectively. Which one of the following holds? 1/1

- ○ t1 = 5
- ○ t1 < t2
- ◉ t1 > t2 ✓
- ○ t1 = t2

✓ Q4. 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 1/1

- ◉ O(n^2) ✓
- ○ O(nLogn)
- ○ Theta(nLogn)
- ○ O(n^3)

✓ Q5. In a permutation a1.....an of n distinct integers, an inversion is a pair (ai, aj) such that i < j and ai > aj. What would be the worst case time complexity of the Insertion Sort algorithm, if the inputs are restricted to permutations of 1.....n with at most n inversions? 1/1

- Θ (n^2)
- Θ (n log n)
- Θ (n^1.5)
- ◉ Θ (n) ✓

✗ Q6. Randomized quicksort is an extension of quicksort where the pivot is chosen randomly. What is the worst case complexity of sorting n numbers using randomized quicksort? 0/1

- O(n)
- O(n Log n)
- O(n^2)
- ◉ O(n!) ✗

Correct answer

- ◉ O(n Log n)

Feedback

Randomized quicksort has expected time complexity as O(nLogn), but worst case time complexity remains same. In worst case the randomized function can pick the index of corner element every time.

✓ Q7. Which of the following changes to typical QuickSort improves its performance on average and are generally done in practice. 1) Randomly picking up to make worst case less likely to occur.2) Calling insertion sort for small sized arrays to reduce recursive calls.3) QuickSort is tail recursive, so tail call optimizations can be done.4) A linear time median searching algorithm is used to pick the median, so that the worst case time reduces to O(nLogn) 1/1

- ○ 1 and 2
- ○ 2, 3, and 4
- ◉ 1, 2 and 3 ✓
- ○ 2, 3 and 4

✓ Q8. Which one of the following is the recurrence equation for the worst case time complexity of the Quicksort algorithm for sorting n(≥ 2) numbers? In the recurrence equations given in the options below, c is a constant. 1/1

- ○ T(n) = 2T (n/2) + cn
- ◉ T(n) = T(n − 1) + T(0) + cn ✓
- ○ T(n) = 2T (n − 2) + cn
- ○ T(n) = T(n/2) + cn

✓ Q9. Assume that a mergesort algorithm in the worst case takes 30 seconds for an input of size 64. Which of the following most closely approximates the maximum input size of a problem that can be solved in 6 minutes? 1/1

- ○ 256
- ◉ 512 ✓
- ○ 1024
- ○ 2048

✓ Q10. Assume that the algorithms considered here sort the input sequences in ascending order. If the input is already in ascending order, which of the following are TRUE ? I. Quicksort runs in Θ(n2) time II. Bubblesort runs in Θ(n2) time III. Mergesort runs in Θ(n) time IV. Insertion sort runs in Θ(n) time 1/1

- ○ I and II only
- ○ I and III only
- ○ II and IV only
- ◉ I and IV only ✓

✓ Q11. Assume that we use Bubble Sort to sort n distinct elements in ascending order. When does the best case of Bubble Sort occur? 1/1

- (●) When elements are sorted in ascending order ✓
- ( ) When elements are sorted in descending order
- ( ) When elements are not sorted by any order
- ( ) There is no best case for Bubble Sort. It always takes O(n*n) time

✓ Q12. If we use Radix Sort to sort n integers in the range (n^k/2,n^k], for some k>0 which is independent of n, the time taken would be? 1/1

- ( ) Θ(n)
- ( ) Θ(kn)
- (●) Θ(nlogn) ✓
- ( ) Θ(n^2)

✓ Q13. Consider an array of elements arr[5]= {5,4,3,2,1} , what are the steps of insertions done while doing insertion sort in the array. 1/1

- (●) 4 5 3 2 1 3 4 5 2 1 2 3 4 5 1 1 2 3 4 5 ✓
- ( ) 5 4 3 1 2 5 4 1 2 3 5 1 2 3 4 1 2 3 4 5
- ( ) 4 3 2 1 5 3 2 1 5 4 2 1 5 4 3 1 5 4 3 2
- ( ) 4 5 3 2 1 2 3 4 5 1 3 4 5 2 1 1 2 3 4 5

✓ Q14. Which is the correct order of the following algorithms with respect to their time Complexity in the best case ? 1/1

- ○ Merge sort > Quick sort >Insertion sort > selection sort
- ◉ insertion sort < Quick sort < Merge sort < selection sort ✓
- ○ Merge sort > selection sort > quick sort > insertion sort
- ○ Merge sort > Quick sort > selection sort > insertion sort

✓ Q15. Which of the following statements is correct with respect to insertion sort ? *Online - can sort a list at runtime*Stable - doesn't change the relative order of elements with equal keys. 1/1

- ◉ Insertion sort is stable, online but not suited well for large number of elements. ✓
- ○ Insertion sort is unstable and online.
- ○ Insertion sort is online and can be applied to more than 100 elements.
- ○ Insertion sort is stable & online and can be applied to more than 100 elements.

✓ Q16. Consider the array A[]= {6,4,8,1,3} apply the insertion sort to sort the array . Consider the cost associated with each sort is 25 rupees , what is the total cost of the insertion sort when element 1 reaches the first position of the array? 1/1

- (●) 50 ✓
- ( ) 25
- ( ) 75
- ( ) 100

✓ Q17. The auxiliary space of insertion sort is O(1), what does O(1) mean ? 1/1

- ( ) The memory (space) required to process the data is not constant.
- (●) It means the amount of extra memory Insertion Sort consumes doesn't depend on the input. The algorithm should use the same amount of memory for all inputs. ✓
- ( ) It takes only 1 kb of memory.
- ( ) It is the speed at which the elements are traversed.

✓ Q18. What is the best sorting algorithm to use for the elements in array are more than 1 million in general? 1/1

- ○ Merge sort
- ○ Bubble sort.
- ◉ Quick sort. ✓
- ○ Insertion sort.

✓ Q19. Which of the below given sorting techniques has highest best-case runtime complexity? 1/1

- ○ Quick sort
- ◉ Selection sort ✓
- ○ Insertion sort
- ○ Bubble sort

✓ Q20. If one uses straight two-way merge sort algorithm to sort the following elements in ascending order 20, 47, 15, 8, 9, 4, 40, 30, 12, 17 then the order of these elements after the second pass of the algorithm is: 1/1

- ○ 8, 9, 15, 20, 47, 4, 12, 17, 30, 40
- ◉ 8, 15, 20, 47, 4, 9, 30, 40, 12, 17 ✓
- ○ 15, 20, 47, 4, 8, 9, 12, 30, 40, 17
- ○ 4, 8, 9, 15, 20, 47, 12, 17, 30, 40

✓ Q21. Quicksort is run on two inputs shown below to sort in ascending order taking first element as pivot,(i) 1, 2, 3,....., n(ii) n, n-1, n-2,....., 2, 1 Let C1 and C2 be the number of comparisons made for the inputs (i) and (ii) respectively. Then, 1/1

- ○ C1 < C2
- ○ C1 > C2
- ◉ C1 = C2 ✓
- ○ We cannot say anything for arbitrary n

✓ Q22. Quick sort is run on 2 inputs shown below to sort in ascending order A. 1, 2, 3.....n B. n, n – 1, n – 2 ..... 1. Let C1 and C2 be the number of comparisons made for A and B respectively. Then 1/1

- ○ C1 > C2
- ◉ C1 = C2 ✓
- ○ C1 < C2
- ○ Cannot say anything for arbitrary n

✓ Q23. You are given a sequence of n elements to sort. The input sequence consists of n/k subsequences, each containing k elements. The elements in a given subsequence are all smaller than the elements in the succeeding subsequence and larger than the elements in the preceding subsequence. Thus, all that is needed to sort the whole sequence of length n is to sort the k elements in each of the n/k subsequences. The lower bound on the number of comparisons needed to solve this variant of the sorting problem is 1/1

- Ω (n)
- Ω (n/k)
- Ω (nlogk) ✓
- Ω (n/klogn/k)

✓ Q24. Which of the following is true for computation time in insertion, deletion and finding maximum and minimum element in a sorted array ? 1/1

- Insertion – 0(1), Deletion – 0(1), Maximum – 0(1), Minimum – 0(l)
- Insertion – 0(1), Deletion – 0(1), Maximum – 0(n), Minimum – 0(n)
- Insertion – 0(n), Deletion – 0(n), Maximum – 0(1), Minimum – 0(1) ✓
- Insertion – 0(n), Deletion – 0(n), Maximum – 0(n), Minimum – 0(n)

✓ Q25. Consider the following sorting algorithms. I. Quicksort II. Heapsort III. Mergesort Which of them perform in least time in the worst case? 1/1

- ○ I and II only
- ◉ II and III only ✓
- ○ III only
- ○ I, II and III

✓ Q26. Which of the following algorithms sort n integers, having the range 0 to (n^2 - 1), in ascending order in O(n) time ? 1/1

- ○ Selection sort
- ○ Bubble sort
- ◉ Radix sort ✓
- ○ Insertion sort

✓ Q27. Selection sort algorithm design technique is an example of 1/1

- ◉ Greedy method ✓
- ○ Divide-and-conquer
- ○ Dynamic Programming
- ○ Backtracking

✓ Q28. You have to sort a list L, consisting of a sorted list followed by a few ‘random’ elements. Which of the following sorting method would be most suitable for such a task? 1/1

- ○ Bubble sort
- ○ Selection sort
- ○ Quick sort
- ◉ Insertion sort ✓

AD1 Quiz

Total points 10/10

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✓ Q1. We use dynamic programming approach when 1/1

- ○ We need an optimal solution
- ◉ The solution has optimal substructure ✓
- ○ The given problem can be reduced to the 3-SAT problem
- ○ It's faster than Greedy

✓ Q2. Four matrices M1, M2, M3 and M4 of dimensions pxq, qxr, rxs and sxt respectively can be multiplied is several ways with different number of total scalar multiplications. For example, when multiplied as ((M1 X M2) X (M3 X M4)), the total number of multiplications is pqr + rst + prt. When multiplied as (((M1 X M2) X M3) X M4), the total number of scalar multiplications is pqr + prs + pst.If p = 10, q = 100, r = 20, s = 5 and t = 80, then the number of scalar multiplications needed is 1/1

- ○ 248000
- ○ 44000
- ◉ 19000 ✓
- ○ 25000

✓ Q3. The subset-sum problem is defined as follows. Given a set of n positive integers, S = {a1 ,a2 ,a3 ,...,an} and positive integer W, is there a subset of S whose elements sum to W? A dynamic program for solving this problem uses a 2-dimensional Boolean array X, with n rows and W+1 columns. X[i, j],1 <= i <= n, 0 <= j <= W, is TRUE if and only if there is a subset of {a1 ,a2 ,...,ai} whose elements sum to j. Which of the following is valid for 2 <= i <= n and ai <= j <= W? 1/1

- ○ X[i, j] = X[i − 1, j] ∨ X[i, j -ai]
- ◉ X[i, j] = X[i − 1, j] ∨ X[i − 1, j − ai] ✓
- ○ X[i, j] = X[i − 1, j] ∧ X[i, j − ai]
- ○ X[i, j] = X[i − 1, j] ∧ X[i -1, j − ai]

✓ Q4. In the above question, which entry of the array X, if TRUE, implies that there is a subset whose elements sum to W? 1/1

- ○ X[1, W]
- ○ X[n ,0]
- ◉ X[n, W] ✓
- ○ X[n -1, n]

✓ Q5. Let A1, A2, A3, and A4 be four matrices of dimensions 10 x 5, 5 x 20, 20 x 10, and 10 x 5, respectively. The minimum number of scalar multiplications required to find the product A1A2A3A4 using the basic matrix multiplication method is 1/1

- (●) 1500 ✓
- ( ) 2000
- ( ) 500
- ( ) 100

✓ Q6. The following paradigm can be used to find the solution of the problem in minimum time: Given a set of non-negative integer, and a value K, determine if there is a subset of the given set with sum equal to K: 1/1

- ( ) Divide and Conquer
- (●) Dynamic Programming ✓
- ( ) Greedy Algorithm
- ( ) Branch and Bound

✓ Q7. What happens when a top-down approach of dynamic programming is applied to any problem? 1/1

- ○ It increases both, the time complexity and the space complexity.
- ◉ It increases the space complexity and decreases the time complexity. ✓
- ○ It increases the time complexity and decreases the space complexity.
- ○ It decreases both, the time complexity and the space complexity.

✓ Q8. In a village, people build houses in the same side of the road. A thief plans to loot the village. He wants maximum amount of money without having any risk of getting caught. By some means, the villagers know that their adjacent house is being looted or not and thus they become alert. So the thief cannot loot contiguous two houses. Given that the thief knows the amount of money stored in each house and the road is straight and there is no turning, which is the most efficient algorithmic strategy to solve this problem? 1/1

- ○ Brute-force
- ◉ Dynamic Programming ✓
- ○ Backtracking
- ○ Divide and Conquer

✓ Q9. An element in an array X is called a leader if it is greater than all elements to the right of it in X. The best algorithm to find all leaders in an array 1/1

- ○ Solves it in linear time using a left to right pass of the array
- ◉ Solves it in linear time using a right to left pass of the array ✓
- ○ Solves it using divide and conquer in time theta(nlogn)
- ○ Solves it in time theta(n2)

✓ Q10. An inversion in a an array A[] is a pair (A[i], A[j]) such that A[i] > A[j] and i < j. An array will have maximum number of inversions if it is: 1/1

- ○ Sorted in increasing order
- ◉ Sorted in decreasing order ✓
- ○ Sorted in alternate fashion
- ○ Both A and B

Name and Regd. No.: _____

ALGORITHM DESIGN 1(CSE3131)

Quiz 1

- You are allowed to use only those concepts which are covered in the lecture class till date

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JULY 17, 2021

1. (2 points) Draw the recursive tree for computing fibonacci(5) using cache memory. Also show the dynamic table.

2. (2 points) How many operations are required to convert GOD to MOODY using minimum edit distance?

3. (2 points) Find the longest common subsequence of "abbcadbcab" and "abcdcdbacab".

4. Given an iterative algorithm SORTEDINSERT, which inserts the key k into an already sorted array A and maintains the sorted order of the array.

```
SORTEDINSERT(A,k)
1   i = length(A)
2   while i > 0 and k < A[i]
3   A[i + 1] = A[i]
4       i = i − 1
5   A[i + 1] = k
```

   (a) (2 points) Perform a line-by-line analysis of SORTEDINSERT and derive a precise (non-asymptotic) expression of the running time $T(n)$, where n = length(A). You may assume a cost $c_i = 1$ for each line of pseudo code.

(b) (2 points) Describe the best-case scenario for SortedInsert and give both a precise and asymptotically-tight bound on the best-case running time.

(c) (2 points) Describe the worst-case scenario for SortedInsert and give both a precise and asymptotically-tight bound on the worst-case running time.

5. Consider the algorithm for SORTEDINSERT that first uses binarysearch to find the position for key k and then shifts over the elements to the right and inserts k.

```
SORTEDINSERT(A,k)
1   n = length(A)
2   i = Search(A,k,1,n)
3   for j = n to i + 1
4   A[j+1]=A[j]
5   A[i+1] = k

SEARCH(A,k,p,r)
1   if p < r
2       q = ⌊(p+r)/2⌋
3       if k ≤ A[q]
4           return SEARCH(A,k,p,q)
5       else return SEARCH(A,k,q+1,r)
6   else return p
```

(a) (2 points) Give a recurrence describing the worst-case running time $T(n)$ of SEARCH, where $n = r - p + 1$.

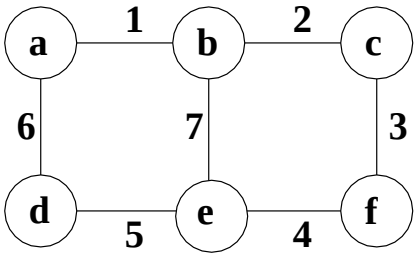
(b) (2 points) Give an asymptotically-tight bound for the worst-case running time of this version of SORTEDINSERT. You do not have to solve the recurrence.

6. (2 points) Solve the following recurrence using the master method. Show your work.

$$T(n) = \begin{cases} \Theta(1) & n = 1 \\ T(n/2) + \Theta(1) & n > 1 \end{cases}$$

7. (2 points) Draw the DP table to compute C(7,6)[Binomial Coefficient].

8. (2 points) Show the minimum spanning tree of the following graph.



9. (2 points) What is the amortized asymptotic running time of MST-KRUSKAL on graph $G = (V, E)$ using the disjoint sets data structure with union by rank and pathcompression?

10. (2 points) What is the amortized asymptotic running time of MST-PRIM on graph $G = (V, E)$ using the array data structure?

11. (2 points) For which type of graphs will MST-PRIM asymptotically outperform MST-KRUSKAL?

12. (2 points) Solve the following recurrence relations. Find an exact solution for T(n):

a) $T(n) = T(n - 1) + n/3; \quad T(1) = 1$

✓ Which one of the following is not characteristic features of an algorithm 1/1

- Finiteness
- Effectiveness
- Definiteness
- **Computitiveness** ✓

✓ Each instruction of the algorithm should be clear and unambiguous. This characteristic feature of algorithm is called 1/1

- **Definiteness** ✓
- Effectiveness
- Efficiency
- Finiteness

✗ Which one of the following is not a method of algorithm correctness? 0/1

- Counter-examples
- **Loop invariants** ✗
- Maintenance
- Induction method

Correct answer

- **Maintenance**

✓ How many comparisons are possible for input size = 10 in insertion sort for the best, and worst cases 1/1

- **9, 45** ✓
- 45, 9
- 9, 100
- 20, 55

✓ How many comparisons are possible for bubble sort for input size n 1/1

- **n(n-1)/2** ✓
- n^2
- $(n^2)-n)/2$
- $n^2/2$

✗ What is the time complexity of Build Heap operation. Build Heap is used to build a master min/ binary heap from a given array. Build Heap is used in Heap Sort as a first step for sorting. 0/1

- O(n^2)
- O(nLogn) ✗
- **O(Logn)**
- O(n)

Correct answer

- O(n)

✓ Consider a binary max-heap implemented using an array. Which one of the following array represents a binary max-heap? 1/1

- 25,12,16,13,10,8,14
- **25,14,16,13,10,8,12** ✓
- 25,14,12,13,10,8,16
- 25,14,12,13,10,8,28

✓ Consider a max heap, represented by the array: 40, 30, 20, 10, 15, 16, 17, 8, 4. Now consider that a value 18 is inserted into this heap. After insertion, the new heap is 1/1

- 40, 30, 20, 10, 18, 15, 16, 17, 8, 4, 35
- **40, 35, 20, 10, 30, 15, 16, 17, 8, 4, 15** ✓
- 40, 35, 20, 10, 20, 15, 16, 17, 8, 4, 15
- 40, 35, 20, 10, 15, 16, 17, 8, 4, 38

Consider the following graph

✓ The number of distinct minimum spanning trees for the weighted graph below is 1/1

- 4
- 5
- **6** ✓
- 7

✓ The best data structure to check whether an arithmetic expression has balanced parentheses is a 1/1

- **Stack** ✓
- Queue
- tree
- list

Suppose we run Dijkstra's single source shortest-path algorithm on the following edge-weighted directed graph with vertex P as the source.

In what order do the nodes get included into the set of vertices for which the shortest path distances are finalized? 1/1

- P, Q, R, S, T, U
- **P, Q, R, U, S, T** ✓
- P, Q, R, U, T, S
- P, Q, T, R, U, S

✓ A networking company uses a compression technique to encode the message before transmitting over the network. Suppose the message contains the following characters with their frequency: character Frequency a 6 b 9 c 12 d 13 e 16 f 45 Note : Each character in input message takes 1 byte. If the compression technique used is Huffman Coding, how many bits will be saved in the message? 1/1

- 224
- 800
- **576** ✓
- 324

✓ Suppose the letters a, b, c, d, e, f 1/1 have probabilities 1/2, 1/4, 1/8, 1/16, 1/32, 1/32 respectively. Which of the following is the Huffman code for the letter a, b, c, d, e, f?

- **0, 10, 110, 1110, 11110, 11111** ✓
- 11, 10, 011, 010, 001, 000
- 11, 10, 01, 001, 0001, 0000
- 110, 100, 010, 000, 001, 111

- Option 1

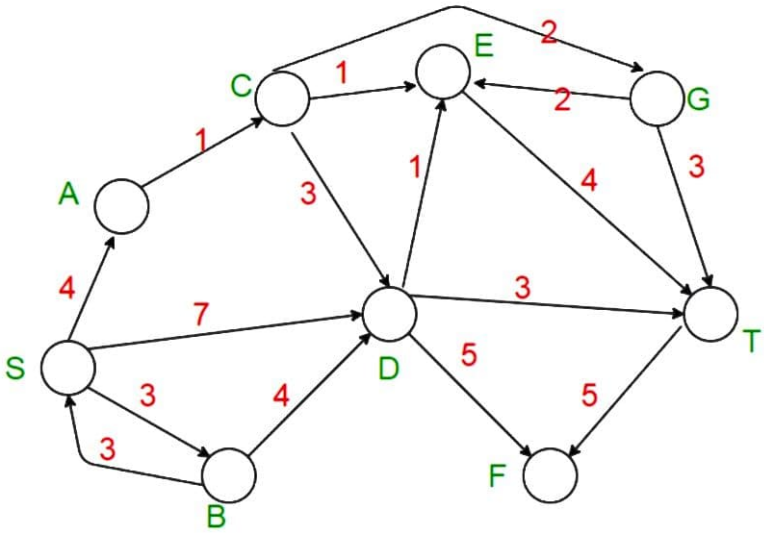
Consider the undirected graph below:

✓ Using Prim's algorithm to construct a minimum spanning tree starting with node A, which one of the following sequences of edges represents a possible order in which the edges would be added to construct the minimum spanning tree? 1/1

- (E, G), (F, F), (F, G), (A, D), (A, B), (A, C)
- (A, D), (A, B), (A, C), (C, F), (G, E), (F, G)
- (A, B), (A, D), (D, F), (F, G), (G, E), (F, C)
- **(A, D), (A, B), (D, F), (F, G), (F, C), (G, E)** ✓

- Four matrices M1, M2, M3 and M4 of dimensions pxq, qxr, rxs and sxt respectively can be multiplied in several ways with different number of total scalar multiplications. For example, when multiplied as ((M1 X M2) X (M3 X M4)), the total number of multiplications is pqr + rst + prt. When multiplied as (((M1 X M2) X M3) X M4), the total number of scalar multiplications is pqr + prs + pst.If p = 10, q = 100, r = 20, s = 5 and t = 80, then the number of scalar multiplications needed is

Consider the given graph.



Consider the directed graph shown in the figure. There are multiple shortest paths between vertices S and T. Which one will be reported by Dijstras shortest path algorithm? Assume that, in any iteration, the shortest path to a vertex v is updated only when a strictly shorter path to v is discovered. 1 point

- SDT
- SBDT
- SACDT
- SACET

(E, G), (C, F), (E, G), (A, D), (A, B), (A, C)

(A, D), (A, B), (A, C), (C, F), (G, E), (F, C)

(A, B), (A, D), (B, F), (F, C), (G, E), (F, C)

(A, D), (A, B), (B, F), (F, C), (F, E), (G, E) ✓

✓ Four matrices M1, M2, M3 and M4 1/1
of dimensions pxq, qxr, rxs and
sxt respectively can be multiplied
is several ways with different
number of total scalar
multiplications. For example,
when multiplied as ((M1 X M2) X
(M3 X M4)), the total number of
multiplications is pqr + rst + prt.
When multiplied as (((M1 X M2) X
M3) X M4), the total number of
multiplications is pqr + prs
+ prt.If p = 10, q = 100, r = 20, s =
5 and t = 80, then the number of
scalar multiplications needed is

248000

44000

19000 ✓

25000

✓ Let A1, A2, A3, and A4 be four 1/1
matrices of dimensions 10 x 5, 5 x
20, 20 x 10, and 10 x 5,
respectively. The minimum
number of scalar multiplications
required to find the product
A1A2A3A4 using the basic matrix
multiplication method is

1500 ✓

2000

500

100

✗ Which of the following standard 0/1
algorithms is not a Greedy
algorithm?

Dijkstra's shortest path algorithm

Prim's algorithm ✗

Huffman Coding

Bellman Ford Shortest path algorithm

Correct answer

Bellman Ford Shortest path algorithm

✓ What is the time complexity of 1/1
Huffman Coding?

(A) O(N)

(B) O(NlogN) ✓

(C) O(NloglogN^2)

(D) O(N^2)

✗ Consider 6 characters with their 0/1
frequencies as follows, a = 42, b =
20, c = 5, d = 10, e = 11, f = 12.
What will be the sequence of
characters corresponding to the
code = 10001011101110111010101?

eafdbcafa

eafdcbfef

eafdcbafa

eafdbcfef

✓ The computational complexity of 1/1
solving Fibonacci series for N
terms using Dynamic
programming is

O(2^N)

O(N) ✓

O(N^2)

O(N^3)

✓ What is the time complexity of 1/1
the recursive implementation
used to find the nth fibonacci
term?

O(1)

O(n2)

O(n!)

Exponential ✓

✓ Which of the following is the 1/1
recurrence relation for the matrix
chain multiplication problem
where mat[i-1] * mat[i] gives the
dimension of the ith matrix?

dp[i,j] = 1 if i=j, dp[i,j] = min(dp[i,k] +
dp[k+1,j]

dp[i,j] = 0 if i=j, dp[i,j] = min(dp[i,k] +
dp[k+1,j]

dp[i,j] = 1 if i=j, dp[i,j] = min(dp[i,k] +
dp[k+1,j] + mat[i-1]*mat[k]*mat[j]

dp[i,j] = 0 if i=j, dp[i,j] = min(dp[i,k] +
dp[k+1,j] + mat[i-1]*mat[k]*mat[j] ✓

✓ Consider the strings 1/1
"PQRSTPQRS" and
"PRATPBQRPS". What is the
length of the longest common
subsequence?

9

8

7 ✓

6

✓ Consider the strings "monday" 1/1
and "tuesday". What is the edit
distance between the two
strings?

3

4 ✓

5

6

✓ Consider the two strings: 1/1
("empty string) and "abcd" .
What is the edit distance
between the two strings?

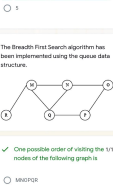
3

0

4 ✓

5

The Breadth First Search algorithm has
been implemented using the queue data
structure.



✓ One possible order of visiting the 1/1
nodes of the following graph is

MNOPQR

NQMPOR

QMNPRO ✓

QMNPQR

Consider the DAG with Consider V = {1, 2,
3, 4, 5, 6}, shown below.

✓ Which of the following is NOT a 1/1
topological ordering?

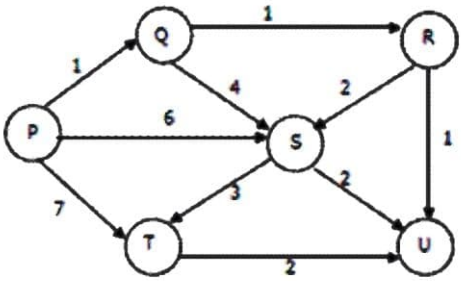
1 2 3 4 5 6

1 3 2 4 5 6

1 3 2 4 6 5

3 2 4 1 6 5 ✓

Suppose we run Dijkstra's single source shortest-path algorithm on the following edge weighted directed graph with vertex P as the source.



In what order do the nodes get included into the set of vertices for which the shortest path distances are finalized? 1 point

- P, Q, R, S, T, U
- P, Q, R, U, S, T
- P, Q, R, U, T, S
- P, Q, T, R, U, S

A networking company uses a compression technique to encode the message before transmitting 1 point