Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Course: Design and Analysis of Algorithms
Semester: IV
Programme: B.Tech. CSE+BFSI

Time: 02 hrs.
Max. Marks: 100

Instructions: Attempt All the question.

Description	
Instructions	
Total Questions	60
Total Points	100

Number of Attempts 45

Points: 2

1. Multiple Choice: Q1:

Question 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?

Answer

a. P,Q,R,S,T,U

b. P,Q,R,U,S,T

c. P,Q,R,U,T,S

d. P,Q,T,R,U,S

2. M

ultiple Choice: Q2: Points: **2**

Question	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: Char. Freq. a 5 b 9 c 12 d 13 e 16 f 45 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?
Answer	a. 224 b. 800 c. 556 d. 324

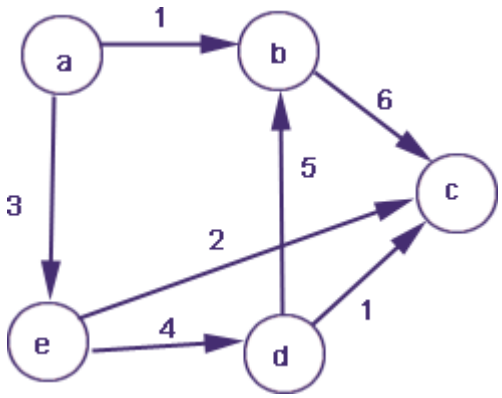
3. Multiple Choice: Q3:

Points: **2**

Question	The minimum number of record movements required to merge five files A (with 8 records), B (with 20 records), C (with 16 records), D (with 5 records) and E (with 23 records) is:
Answer	a. 120 b. 157 c. 73 d. 79

Points: 2

4. Multiple Choice: Q4:

Question	In the given graph:  Identify the shortest path having minimum cost to reach vertex ‘e’ if ‘a’ is the source vertex.
Answer	a. a-b-e
	b. a-c-e
	c. a-c-d-e
	d. a-c-d-b-e

Points: 2

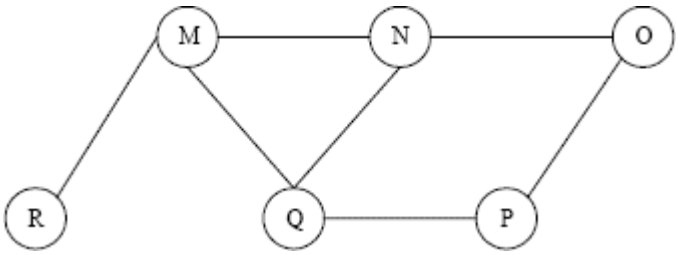
5. Multiple Choice: Q5:

Question	What is the minimum height for a binary search tree with 6 Nodes?
Answer	a. 1
	b. 3

	c. 4
	d. 2

Points: 2

6. Multiple Choice: Q6:

Question	The Breadth First Search algorithm has been implemented using the queue data structure. One possible order of visiting the nodes of the following graph is 
Answer	a. MNOPQR
	b. QMNPRO
	c. ONMRPQ
	d. QPORNM

7. Multiple Choice: Q7:

Points: 2

Question	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?
Answer	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

Points: 2

8. Multiple Choice: Q8:

Question	An automobile company has a sequence of jobs to perform. The jobs are named as (1, 2, 3, 4, 5, 6) and the associated profit of these jobs are (35, 20, 18, 16, 30). A penalty is also associated with these jobs if not get within the deadline. The deadline of these jobs are (1, 3, 4, 3, 2, 1, 2). Job assignment is done using Greedy strategy and penalty cost of the jobs left. Assume that the penalty if misses the deadline is 10/job. Which is the correct assignment and penalty cost?
Answer	a. (1,5,6) and 30 b. (7,6,4,3) and 20 c. (2,1,7) and 40 d. (1,3) and 40

9. Multiple Choice: Q9:

Points: 2

Question

Consider the weights and values of items listed below. Note that there is only one unit of each item.

S. No.	Weight	Value
1	10	60
2	7	28
3	4	20
4	2	24

The task is to pick a subset of these items such that their total weight is no more than 11 Kgs and their total value is maximized. Moreover, no item may be split. The total value of items picked by an optimal algorithm is denoted by V_{opt}. A greedy algorithm sorts the items by their value-to-weight ratios in descending order and packs them greedily, starting from the first item in the ordered list. The total value of items picked by the greedy algorithm is denoted by V_{greedy}. The value of $V_{opt} - V_{greedy}$ is:

Answer

a. 16

b. 8

c. 44

d. 60

Points: 2

10. True / False: Q10:

Question

In a weighted graph, assume that the shortest path from a source ‘s’ to a destination ‘t’ is correctly calculated using a shortest path algorithm. Is the following statement true? If we increase weight of every edge by 1, the shortest path always remains same.

Answer

True

False

11. Multiple Choice: Q11:

Points: 1

Question	Consider f(x) and g(x) are two functions such that f(x) = n^3 and g(x) =3n, which of the following asymptotic equality holds true:
Answer	a. f(n) = Θ(g(n))
	b. f(n) = big Omega(g(n))
	c. g(n) = O(f(n))
	d. f(n) = O(g(n))

12. Multiple Choice: Q12:

Points: 1

Question	For any two functions f(n) and g(n), we have f(n) = Θ(g(n)) if and only if
Answer	a. f(n) = O(g(n))
	b. f(n) = Ω(g(n))
	c. Both of these
	d. None of these

13. Multiple Choice: Q13:

Points: 1

Question	Which of the following is true?
Answer	a. A graph may contain no edges and many vertices
	b. A graph may contain no edges and no vertices
	c. A graph may contain many edges and no vertices
	d. A graph may contain no vertices and many edges

14. Multiple Choice: Q14:

Points: 1

Question	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?
Answer	a. v=e
	b. v + 1 = e
	c. v = e-1
	d. v = e+1

15. Multiple Choice: Q15:

Points: 1

Question	A graph with all vertices having equal degree is known as a _____
Answer	a. Multi Graph
	b. Simple Graph
	c. Complete Graph
	d. Regular Graph

Points: 1

16. Multiple Choice: Q16:

Question	Which of the following ways can be used to represent a Graph?
Answer	a. No way to represent
	b. Incidence Matrix
	c. Adjacency List, Adjacency Matrix as well as Incidence Matrix
	d. Adjacency List and Adjacency Matrix

17. Multiple Choice: Q17:

Points: 1

Question	The number of elements in the adjacency matrix of a graph having 7 vertices is
Answer	a. 14
	b. 49
	c. 36
	d. 7

18. Multiple Choice: Q18:

Points: 1

Question	In Huffman coding, data in a tree always occur?
Answer	a. leaves
	b. left sub trees

	c. roots
	d. right sub trees

Points: 1

19. Multiple Choice: Q19:

Question	Which of the following algorithm design technique is used in the quick sort Algorithm?
Answer	a. Divide-and-conquer
	b. Backtracking
	c. Dynamic programming
	d. Greedy method

20. Multiple Choice: Q20:

Points: 1

Question	Time complexity of counting sort is
Answer	a. Linear
	b. Quadratic
	c. Exponential
	d. None of these

21. Multiple Choice: Q21:

Points: 1

Question	What is a chromatic number?

Answer	a. The maximum number of colors required for proper edge coloring of graph
	b. The minimum number of colors required for proper vertex coloring of graph
	c. The maximum number of colors required for proper vertex coloring of graph
	d. The minimum number of colors required for proper edge coloring of graph

Points: 1

22. Multiple Choice: Q22:

Question	Class of graph coloring problem is
Answer	a. P
	b. NP
	c. NP hard
	d. NP Complete

23. Multiple Choice: Q23:

Points: 1

Question	Which data structure will be used for implementation of LC branch and bound
Answer	a. Array
	b. Stack
	c. Queue
	d. Priority Queue

24. Multiple Choice: Q24:

Points: 1

Question	Let X be a problem that belongs to the class NP. Then which one of the following is true?
Answer	a. There is no polynomial time algorithm for X.
	b. If X can be solved deterministically in polynomial time, then P = NP.
	c. If X is NP-hard, then it is NP-complete.
	d. X may be undecidable.

Points: 1

25. Multiple Choice: Q25:

Question	We use dynamic programming approach when
Answer	a. It can be implemented on 0—1 knapsack problem
	b. The solution has optimal substructure
	c. The given problem can be reduced to the 3-SAT problem
	d. The brute-force algorithm is not applicable

26. Multiple Choice: 26:

Points: 1

Question	A sorting technique is called stable if
Answer	a. it takes O(nlogn) time
	b. it maintains the relative order of occurrence of non-distinct elements
	c. it uses divide and conquer strategy
	d. it takes O(n) space

Points: 1

27. Multiple Choice: 27:

Question	The median of n elements can be found in O(n) time. Which one of the following is correct about the complexity of quick sort, in which remains is selected as pivot?
Answer	a. Theta(n)
	b. Theta(n log n)
	c. Theta (n^2)
	d. Theta (n^3)

Points: 1

28. Multiple Choice: Q28:

Question	Select the correct recursive formulation for Fibonacci series.(n>=1)
Answer	a. F(n) = F(n+1) + F(n+2)
	b. F(n) = F(n) + F(n+1)
	c. F(n) = F(n-1) + F(n-2)
	d. F(n) = F(n-1) – F(n-2)

Points: 1

29. Multiple Choice: Q29:

Question	Given a one-dimensional array of integers, you have to find a sub-array with maximum sum. This is the maximum sub-array sum problem. Which of these methods can be used to solve the problem?
Answer	a. Dynamic programming
	b. Two for loops (naive method)
	c. Divide and conquer

d. Dynamic Programming, naive method and Divide and conquer methods.

Points: 1

30. Multiple Choice: Q30:

Question	What is the time complexity of Huffman Coding?
Answer	a. O(n)
	b. O(nlogn)
	c. O(n^2)
	d. None of these

31. Multiple Choice: Q31:

Points: 2

Question	Solve the recurrence T(n) = 3T(√n) + log n by making a change of variables. Your solution should be asymptotically tight.
Answer	a. As does not fit with master theorem, cann't be solved
	b. Θ((log n) ^ log3)
	c. Θ (log n), assume log base 2.
	d. O ((logn)^log3)

32. Multiple Choice: Q32:

Points: 2

Question

	void fun(int n, int arr[])
	{
	int i=0, j=0;
	for (; i<n ; ++i)
	while (j < n && arr[i] < arr[j])
	j++;
	}
	The time complexity of the given code snippet is:

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

33. Multiple Choice: Q33:

Points: **2**

Question	int f(int n)
	{
	if(n <= 1)
	return 1;
	if(n%2 == 0)
	return f(n/2);
	return f(n/2) + f(n/2+1);
	}
	int main()
	{
	printf("%d", f(10));
	return 0;
	}
	What is the output of this recursive function call.

Answer	a. 5 b. 4 c. 3

	d. Stack Overflow Error

Points: 2

34. Multiple Choice: Q34:

Question	The recurrence relation T(n) = 2T(n-1) + a , T(0) = b where a and bare some constants is having equivalent asymptotic notation:
Answer	a. O(n * 2^n)
	b. O(n^2)
	c. O(n^2 * 2^n)
	d. O(2^n)

Points: 2

35. Multiple Choice: Q35:

Question	Select the correct asymptotic complexity of an algorithm with runtime T(n, n) where T(x, c) = Θ(x) for c <= 2, T(c, y) = Θ(y) for c <= 2, and T(x, y) = Θ (x+y) + T(x/2, y/2)
Answer	a. Θ(nLogn)
	b. Θ(n^2Logn)
	c. Θ(n)
	d. Θ(n^2)

36. Multiple Choice: Q36:

Points: 2

Question	Consider the following functions from positives integers to real numbers n!, n2, √n, log n2, log 2n, 1/n. The CORRECT arrangement of asymptotic complexity is:
Answer	a. n2, √n, log n2, log 2n, 1/n, n!

	b. None of these
	c. 1/n, √n, log 2n, log n2, n2, n!
	d. √n, 1/n, n!, log 2n, log n2, n2

Points: 2

37. Multiple Choice: Q37:

Question	Recurrence relation for fibonacci problem is
Answer	a. T(n)=T(n-1)+T(n-2)
	b. T(n)=T(n/2)+ log n
	c. T(n)=2T(n/2) + n^2
	d. T(n)=T(n-1) +n

38. Multiple Choice: Q38:

Points: 2

Question	Let T(n) be the total number of binary sequence of length n. Which of the following correctly depict the equivalent recurrence relation for T(n).
Answer	a. T(n)=T(n-1) * T(n-2), n>2 and T(2) =1 , T(1) =1
	b. T(n)=T(n-1) + T(n-2), n>2 and T(2) =2 , T(1) =2
	c. T(n)=T(n-1) + T(n-2), n>2 and T(2) =3 , T(1) =2
	d. T(n)=T(n-1) + T(n-2), n>2 and T(2) =3 , T(1) =1

39. Multiple Choice: Q39:

Points: 2

Question	The given recurrence relation is T(n)= 2T(n-2) -15; T(2)= 40 and T(1)= 40. The mean of T(0) and T(3) be_____.
Answer	a. 60 b. 46.25 c. 120 d. 32.5

Points: **2**

40. Multiple Choice: Q40:

Question	For the given pseudo code snippet, find the recurrence relation.
	A()
	{
	if (n>1)
	return A(n-1)
	}.

Answer	a. T(n) = 1+ T(n-2) b. T(n) = 1+ T(n-1) c. T(n) = 1+ T(n/2) d. T(n) = T(n-1)

41. Multiple Choice: Q41:

Points: **2**

Question	What is the optimal profit for the following instance of 0/1 knapsack problem usiing dynamic programming; Items: { Apple, Orange, Banana, Melon }, Weight: { 2, 3, 1, 4 }, Profit: { 4, 5, 3, 7 }, Knapsack capacity: 5
Answer	a. 10 b. 11

	c. 12
	d. 9

Points: 2

42. Multiple Choice: Q42:

Question	Explicit constraint for 8 queen problem is
Answer	a. {1,2,3,4}
	b. {1,2,3,4,5,6,7,8}
	c. {1,1,1,1,0,0,0,0}
	d. {1,0,1,0,1,0,1,0}

43. Multiple Choice: Q43:

Points: 2

Question	What is the chromatic number of a graph having n isolated vertices
Answer	a. 0
	b. 1
	c. n
	d. n+1

44. Multiple Choice: Q44:

Points: 2

Question

	Quicksort is running on two inputs shown below to sort in acsending order (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) respectivey. Then,
Answer	a. C1<C2
	b. C1>C2
	c. C1=C2
	d. It cannot be defined due to arbitratory value of "n"

Points: **2**

45. Multiple Choice: 45:

Question	If one uses straight two-way merge sort algorithm to sort the folowing elements in ascending order: 24, 47, 15, 8, 9, 4, 40, 30, 12, 17 then the order of these elements after second pass of the algorithms is
Answer	a. 8,9,15,20,47,4,12,17,30,40
	b. 8,15,20,47,4,9,30,40,12,17
	c. 15, 20, 47,4,8,9,12,30,40,17
	d. 4,8,9,15,20,47,12,17,30,40

46. Multiple Choice: Q46:

Points: **2**

Question	Let s be a sorted array of n integers. Let t(n) denote the time taken for the most efficient algorithm to determine if there are two elements with sum less than 1000 in s. Which of the following statements is true?
Answer	a. t(n) is O(1)
	b. n<=t(n)<=nlogn

c. m

d. none of above

Points: 2

47. Multiple Choice: Q47:

Question	In the following C function,
	let n>=m.
	int gcd(n, m)
	{
	if (n%m==0)
	return m;
	n=n%m;
	return gcd (m,n);
	}
	How many recursive calls are made by this function?

Answer	a. Theta(logn) b. Omega (n) c. Theta(log log n) d. Theta (n^(1/2))

48. Multiple Choice: Q48:

Points: 2

Question

	What will be the space complexity of the following code?
	#include<stdio.h>
	int power(int x, int y)
	{
	if (y == 0)
	return 1;
	else if (y%2 == 0)
	return power(x, y/2)*power(x, y/2);
	else
	return x*power(x, y/2)*power(x, y/2);
	}
	int main()
	{
	int x = 2;
	int y = 3;
	printf("%d", power(x, y));
	return 0;
	}

Answer	a. O(1) b. O(n) c. O(n^2) d. O(nlogn)

Points: **2**

49. Multiple Choice: Q49:

Question	Which of the following recurrence relation Strassen's multiplication applies?
Answer	a. 7T(n/2) + Theta(n^2) b. 8T(n/2) + Theta(n^2) c. 8T(n/2) + O(n^2)

d. 7T(n/2) + O(n^2)

Points: 2

50. Multiple Choice: Q50.: In quick sort, for sorting n elements...

Question	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?
Answer	a. Theta(n)
	b. Theta(n log n)
	c. Theta (n^2)
	d. Theta (n^2 log n)

Points: 2

51. Multiple Choice: Q51:

Question	Let P be a quicksort program to sort numbers in ascending order. Let t1 and t2 be the time taken by the program for the inputs [1 2 3 4] and [5 4 3 2 1] respectively. Which of the following holds?
Answer	a. t1 = t2
	b. t1 > t2
	c. t1 < t2
	d. t1 = t2 + 5 log 5

52. Multiple Choice: Q52:

Points: 2

Question

	"Given 10 activities along with their start and finishing time as:S = (A1, A2, A3, A4, A5, A6, A7, A8, A9, A10), Si = (1,2,3,4,7,8,9,9,11,12), fi = (3,5,4,7,10,9,11,13,12,14), Compute a schedule where the greatest number of activities takes place."
Answer	a. (A1, A3, A4, A7, A9, A6, A10)
	b. (A1, A3, A4, A6, A7, A9, A10)
	c. (A1, A8, A7, A4, A6, A10)
	d. (A1, A8, A5, A4, A6,A3, A10)

Points: **2**

53. Multiple Choice: Q53:

Question	Find the optimal activity schedule for the following task with given weight (wi) (penalties) and deadlines (di) for a uniprocessor machine using greedy approach. Tasks: (T1, T2, T3, T4, T5, T6, T7), di = (4,2,4,3,1,4,6), wi = (70,60,50,40,30,20,10)
Answer	a. 2 4 1 3 7 5 6
	b. 1 4 3 7 6 5
	c. 2 4 3 1 7 5 6
	d. 2 3 4 1 7 5 6

54. Multiple Choice: Q54:

Points: **2**

Question	Given items as {profit, weight} pairs {{40,20},{30,10},{20,5}}. The capacity of knapsack=20. Find the maximum value output assuming items to be divisible
Answer	a. 60
	b. 80
	c. 100
	d. 120

Points: 2

55. Multiple Choice: Q55:

Question	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] then Which statement is correct?
Answer	a. The pivot could be the 7, but it is not the 9
	b. The pivot is not the 7, but it could be the 9
	c. The pivot could be either the 7 or the 9
	d. Neither the 7 nor the 9 is the pivot

56. Multiple Choice: Q56:

Points: 2

Question	How many times the insert and extract min operations are invoked per vertex in Dijkstra's algorithm?
Answer	a. 1
	b. 2
	c. 3
	d. 4

57. Multiple Choice: Q57:

Points: 2

Question	What is the time complexity of Bellman-Ford single-source shortest path algorithm on a complete graph of n vertices?
Answer	a. Θ(n^2Logn)

	b. Θ(n^2)
	c. Θ(n^3)
	d. Θ(n^3Logn)

Points: 2

58. Multiple Choice: Q58:

Question	Knapsack problem can be solved using
Answer	a. Greedy approach
	b. Dynamic Programming Approach
	c. Backtracking Approach
	d. All of the above

59. Multiple Choice: Q59:

Points: 2

Question	Dijkstra's algorithm gives correct result when
Answer	a. Cost of all edges are positive
	b. Cost of all edges are negative
	c. Cost of edges can be positive or negative
	d. None of these

60. Multiple Choice: Q60:

Points: 2

Question

	Bellman ford algorithm gives correct result
Answer	a. Cost of all edges are positive
	b. Cost of all edges are negative
	c. Cost of edges can be positive or negative
	d. None of these