Data Structures and Algorithms (19ECSC201)

100 Again

Semester: III **Division: C** **Year: 2019-20**

A hundred is made, one by one,
Never made, if you only see one.

Total Points: **3700** Threshold you need to cross: **2775 (75% of total score)**

Set A

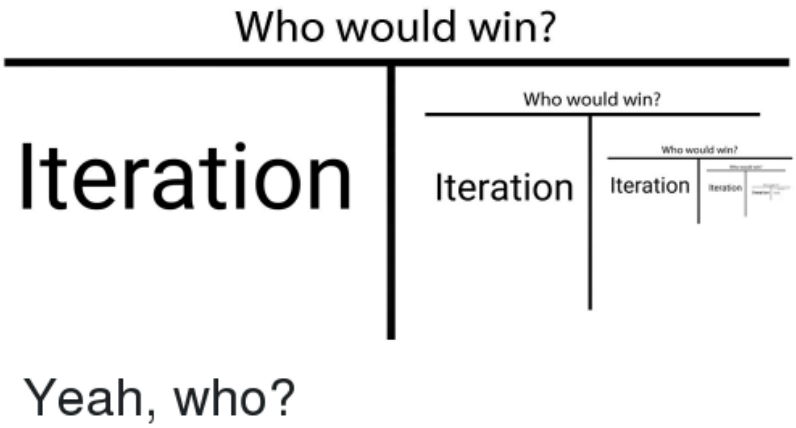
[2 Points each. 5 Points for creative ones, -5 for not answering]

1. Why isn't a graph celebrating No-Shave November?
2. Who gets the award of divide and conquer?
3. Why did heap sort go for transform and conquer?
4. Why was Brute force not allowed to DSA fresher's party?
5. Who is in friends with Warshall's? Dijkstra's or Floyds?
6. Who fixed the substring search?
7. Why was heap proud of its height?
8. Why are the edges relaxed?
9. How is prims different from Kruskals?
10. Which is the best sorting algorithm that you know of, that the sorting algorithm does not know of?
11. If you were to design a T-shirt quote for Kruskal's, then what would be it?
12. What would Kruskal's algorithm purchase in the algorithm's market?
13. Why do you think negatives are equally important as that of positives?
14. What do you get when you combine a merge sort with a merge sort?
15. Who is a better travel guide? Tree of graph?
16. Why doesn't Boyer-Moore never write a mystery novel?
17. If question number 17 was missing, who would be given the task to find it?
18. Why doesn't sorting lie?
19. A string search was initiated on an infinite text pattern. Where do you think the searcher has now reached?
20. Who is the head of algorithms family? Why?

Set B

[50 Points Each]

21.

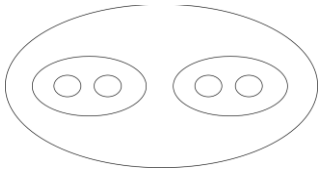


22. Get the keyword

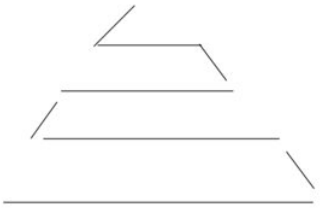
	9	7	7	4	3	3	4

23. Cook a delicious dish using data structures and algorithms as ingredients.

24. Given is the top view, draw the side view.

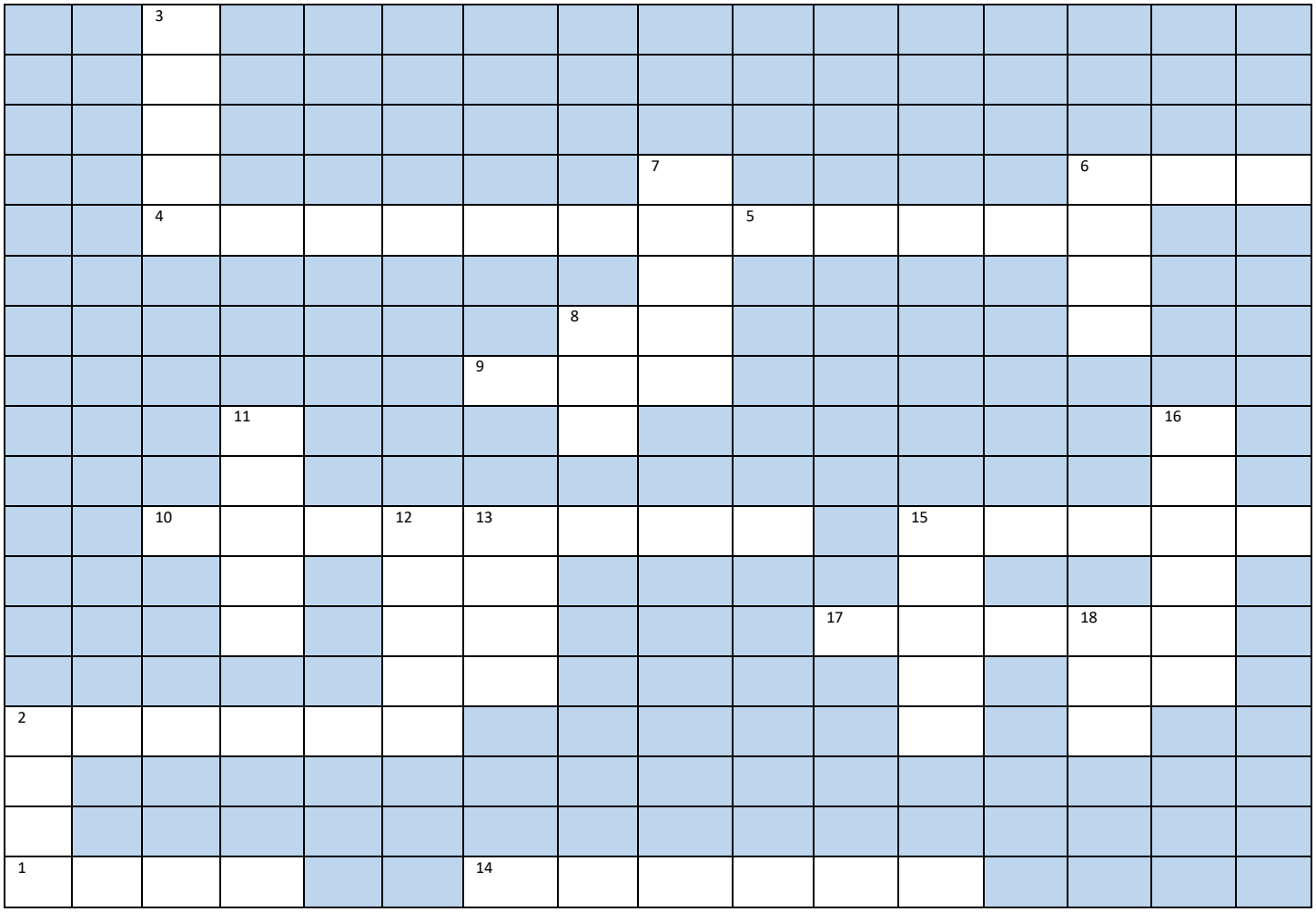


25. What are we talking about?



Set C
[200 Points]

26. Complete the crossword puzzle



Left to Right:

1. ee, It's not Free. But there is a 'r' (4)
2. It's an engine (6)
4. He is in your phone (8)
5. That's how sometimes you express (5)
6. It's a kind of it (3)
9. Maze runners guide (3)
10. Neither reflexive nor symmetric (8)
14. Answer for 13 can help you (6)
15. Even one character would do it (5)
17. To-do (4)

Top to Bottom:

2. The arrange-mental phenomenon (4)
3. Look. It could be Floyd (5)
6. If it was 'I', could have been tasty (4)
7. Greedy (5)
8. Be Something Yes (3)
11. Me, Matrix and list (5)
12. A wrongly spelt FIFO (5)
13. Beep, No (4)
15. It sorts (5)
16. It floats twice (6)
18. Data type dancing upside down (3)

Set D

[5 Points Each]

Define the following terms:

27. Graph	28. Heap	29. Prefix Table	30. Partition Logic
31. Keyword Search	32. Spanning Tree	33. Minimum Spanning Tree	34. Sorting
35. Bubble Sort	36. Rabin-Karp	37. Decrease and Conquer	38. Insertion Sort
39. Selection Sort	40. Merge Sort	41. Quick Sort	42. Bottom Up Heap
43. Bad Symbol Shift Table	44. Binary Insertion Sort	45. Good Suffix Shift Table	46. Heap Sort
47. Negative weight cycle	48. Negative weight edge	49. Shortest path	50. Edge Relaxation

Set E

[20 Points Each]

51. Why is sorting essential? Highlight its importance
52. Construct Prefix table for bababba
53. Construct BSST and GSST for the pattern: 10001
54. How is Horspool's algorithm different from Boyer-Moore?
55. Write a Note on application of graphs
56. Write the mathematical analysis of brute force string search
57. How is divide and conquer different from decrease and conquer
58. Elaborate transform and conquer. What does it mean?
59. Why is brute force an important technique? How can it be improved?
60. Write a short note on Dynamic programming and greedy technique.
61. Apply Rabin-Karp to search 357 in 1235678912335713453
62. Apply Rabin-Karp to search cse in bvbcsklecsklecse
63. On the set of numbers 0 to 15, apply following operations: Union(0, 2), Union(2, 3), Union(8, 15), Union(6, 8)
64. Write code snippets for Union() and find()
65. What do you mean by stable and in-place algortihms?
66. 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 write the recurrence relation for the said description.
67. Write an algorithm for Binary Insertion Sort.
68. Write an improvised algorithm where a merger sort calls an insertion sort. Decide on the split and merge procedure accordingly and an appropriate position to call insertion sort.

Set F

[10 Points for each sub-question, each task]

69. Trace the numbers: 67, 34, 98, 66, 38, 74, 56, 21 for:

a. Bubble Sort	b. Insertion Sort	c. Selection Sort
d. Merge Sort	e. Quick Sort	f. Heap Sort

70. Write the efficiency analysis of following algorithms:

a. Bubble Sort	b. Insertion Sort	c. Selection Sort
d. Merge Sort	e. Quick Sort	f. Heap Sort

71. Trace the set K L E T U C S E for:

a. Bubble Sort	b. Insertion Sort	c. Selection Sort
d. Merge Sort	e. Quick Sort	f. Heap Sort

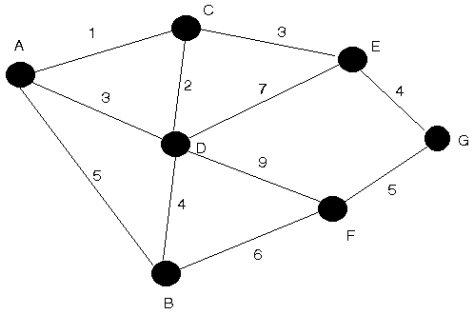
72. Build all substring search tables (Good, Bad, Prefix) for:

a. MANWOMAN b. 001100 c. Mississippi d. WOWMOM

Set G

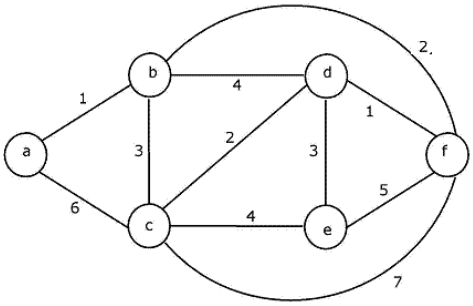
[100 Points Each]

73. For the graph given below, iterate for Prim's and Kruskal's Algorithms:



74. For the graph given in question 73, apply Kruskal's algorithm.

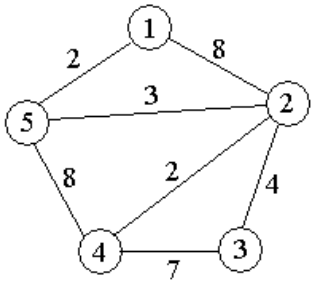
75. Apply Dijkstra's algorithm on the following graph: (consider 'a' as source)



76. For the graph given in question 75, apply prims algorithm.

77. For the graph given in question in 75, convert all even weights to negative weights and apply Bellman Ford algorithm.

78. Apply Floyd's algorithm on:



79. For the graph given in question 78, convert all the weights to 1 and then apply the Warshall's algorithm.

80. For the graph given in question 78 apply both Dijkstras and Bellman-Ford. Compare the two methods.

Set H

[50 Points each, each sub-task]

81. Write algorithm for each of the following:

a. Dijkstra b. Floyd c. Warshall d. Prim e.Kruskal f. Bellman Ford

82. Write the algorithms for the following:

a. Bubble Sort b. Insertion Sort c. Selection Sort d. Merge Sort e. Quick Sort f. Heap Sort

83. Write algorithms for:

a. Rabin-Karp b. BFSS c. Boyer-Moore d. KMP e. Rabin-Karp

Set I

[10 Points each]

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

a. Breadth First Search b. Prim's Minimum Spanning Tree Algorithm

c. Depth First Search d. Kruskal' Minimum Spanning Tree Algorithm

85. 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) Queue 3) Priority Queue 4) Union Find

b. 1) Stack 2) Queue 3) Union Find 4) Priority Queue

c. 1) Queue 2) Stack 3) Priority Queue 4) Union Find

d. 1) Priority Queue 2) Queue 3) Stack 4) Union Find

86. Given two vertices in a graph s and t, which of the two traversals (BFS and DFS) can be used to find if there is path from s to t?

a. Only BFS b. Only DFS

c. Both BFS and DFS d. Neither BFS nor DFS

87. What is the number of edges present in a complete graph having n vertices?

a. (n*(n+1))/2 b. n

c. (n*(n-1))/2 d. Information given is insufficient

88. 10. What is the maximum number of edges in a bipartite graph having 10 vertices?

a. 24 b. 21 c. 25 d. 16

89. 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?

a. 1/8 b. 1 c. 7 d. 8

90. The running time of Bellman-Ford algorithm is lower than that of Dijkstra's Algorithm.

a. True b. False

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

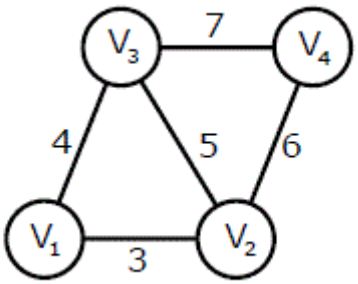
a. Stack b. Heap c. Queue d. Tree

92. Consider a weighted undirected graph with positive edge weights and let (u v) 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?

a. weight (u, v) < 12 b. weight (u, v) ≤ 12

c. weight (u, v) ≥ 12 d. weight (u, v) > 12

93. An undirected graph G(V, E) contains n (n > 2) nodes named v1 , v2 ,….vn. 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?



a. 2n + 1 b. 6n - 11

c. n^2 – n + 1 d. n^2 + n

Set J

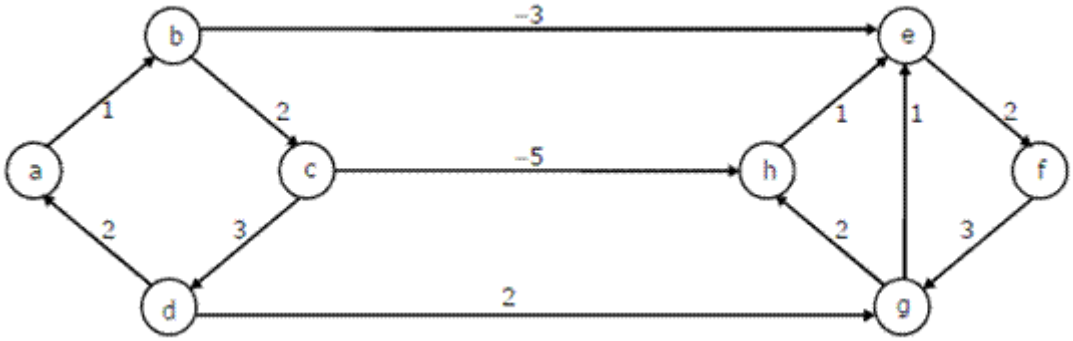
[100 Points each]

94. Consider the weight matrix given below:

$$W = \begin{bmatrix} 0 & 2 & 8 & 5 \\ 2 & 0 & 5 & 8 \\ 8 & 5 & 0 & x \\ 5 & 8 & x & 0 \end{bmatrix}$$

Find the largest possible integer value of x, for which at-least one shortest path between some pair of vertices will contain the edge with weight x.

95. We run Dijkstra's algorithm for the given graph from the source as 'a'. To which of the vertices does it compute the correct shortest path?



96. Write a method to merge three sorted integer arrays into just one array

97. Given an array where each element is maximum + - k index away from its sorted position, find an algorithm to sort such array.

98. What is the best way to sort 1 million floating point numbers? Write the algorithm.

99. You were given a handout case study – 'Graph Case Study' where Ell wanted a strategy to optimize the invitations. Write an algorithm for the case study.

100. An artist had two lists A and B such that B was a permutation of A. Unfortunately, while transporting them from one exhibition to another, some numbers were left out of A. Can you find the missing numbers?

Notes: If a number occurs multiple times in the lists, you must ensure that the frequency of that number in both lists is the same. If that is not the case, then it is also a missing number. You have to print all the missing numbers in ascending order. Print each missing number once, even if it is missing multiple times. The difference between maximum and minimum number in B is less than or equal to 100.

Sample Input

10

203 204 205 206 207 208 203 204 205 206

13

203 204 204 205 206 207 205 208 203 206 205 206 204

Sample Output:

204 205 206

Explanation: 204 is present in both arrays. Its frequency in A is 2, while its frequency in B is 3. Similarly, 205 and 206 occur twice in A, but thrice in B. So, these three numbers are our output. The rest of the numbers have the same frequency in both lists.

MAY THE FORCE BE WITH YOU

- **PH**