Design and Analysis of Algorithm (DAA)

Review Questions

[Set 2]

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Greedy

Assume you have been given tokens of values 25, 10, 5, and 1 unit. What is the minimum number of tokens required to represent 48 units, using a greedy approach? Justify.

Answer: 6

Explanation: Using a greedy approach, the largest token will be considered first, if it can be feasibly selected. Thus, the order of selection will be 25 + 10 + 10 + 1 + 1 + 1 = 48 units.

Huffman Code

Let us consider a file consists of six characters such as A, B, C, D, E, and F having probabilities of 1/2, 1/4, 1/8, 1/16, 1/32, and 1/32 respectively. Determine which of the following codes (Huffman) for the letters A, B, C, D, E, and F?

(a) 0, 10, 110, 1110, 11110, 11111
(b) 11, 10, 01, 001, 0001, 0000
(c) 11, 10, 011, 010, 001, 000
(d) 110, 100, 010, 000, 001, 111

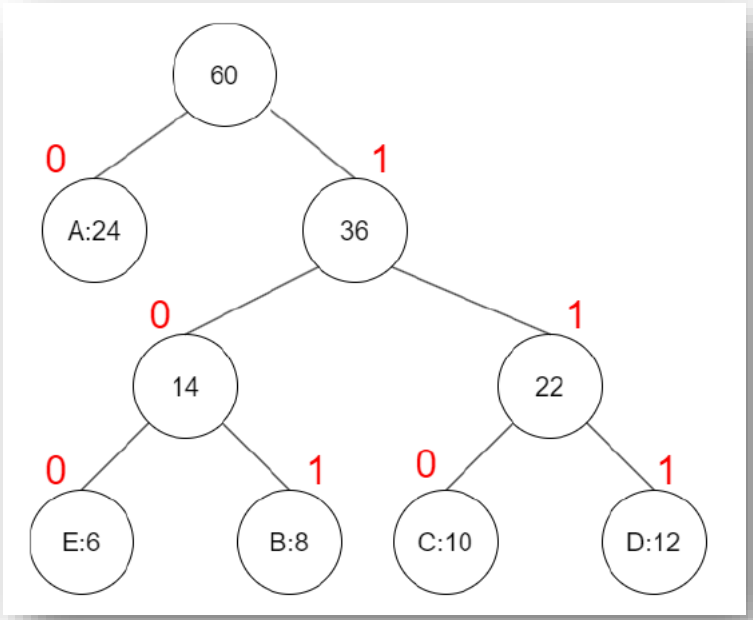
Ans: a

Huffman Code

Generate a Huffman coding scheme for a file containing the following characters and their given frequencies. Show the total number of bits required for encoding a file of 60,000 chars using the generated code.

Character	A	B	C	D	E
Frequency	24	8	10	12	6

Huffman Code



Average Code Length=
((1*24)+(8*3)+(10*3)+(12*3)+(6*3)
)/(24+8+10+12+6)
= 2.2

Total number of bits required for encoding a file of 60,000 chars=
2.2*60,000=1,32,000 bits

Character	A	B	C	D	E
Frequency	24	8	10	12	6
Code	0	101	110	111	100
Code Length	1	3	3	3	3

Knapsack

Given items as {value, weight} pairs {{60,20},{50,25},{20,5}}. The capacity of knapsack=10. Find the maximum value output assuming items to be divisible and non-divisible respectively.

A. 35, 20
B. 50, 20
C. 90, 80
D. 100, 80

Ans: A

Knapsack

Given items as {value, weight} pairs {{60,20},{50,25},{20,5}}. The capacity of knapsack=30. Find the maximum value output assuming items to be divisible and non-divisible respectively.

A. 35, 20
B. 50, 20
C. 90, 80
D. 100, 80

Ans: C

Graph

Which of the following statement is true about adjacency-list representation?

A. Space complexity for both directed and undirected graphs is $O(V^2)$.
B. Space complexity for directed graph is O(V) and Space complexity for undirected graphs O(E)
C. Space complexity for directed graph is $O(V^2)$ and Space complexity for undirected graphs O(V+E)
D. Space complexity for directed graph is O(V+E) and Space complexity for undirected graphs $O(V^2)$
E. Space complexity for both directed graph and undirected graphs is O(V+E)

Ans: E

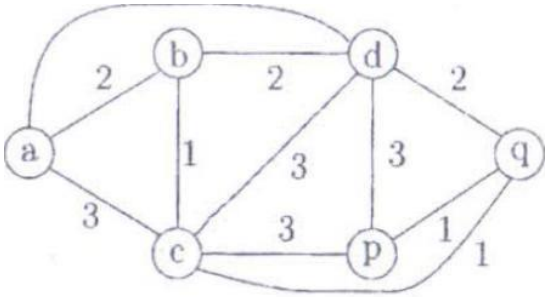
Spanning Tree

A spanning tree of a graph has 100 vertices. By how much will the cost of the spanning tree be increased, if the weight of each edge of the graph is increased by 5 units?

Answer: 495

Explanation: A spanning tree for a graph with 100 vertices will have 99 edges. If the weight of each edge is increased by 5, the total increase in cost will be 99*5 = 495.

Construct the adjacency list of the following weighted graph and demonstrate on it the Kruskal's algorithm for minimum spanning tree. Explain how the relevant parameters and data structures are updated during the execution. In the final step, you should write the MST and its cost. Is this MST unique for this graph?
Use node `a' as source node while answering the question.



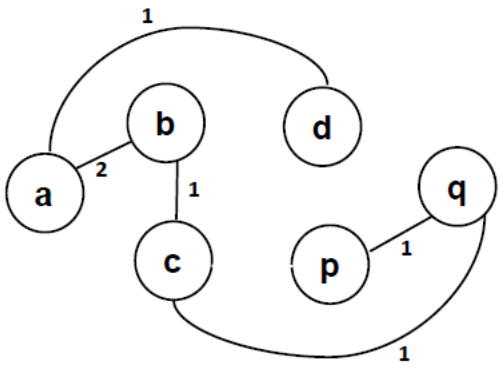
Kruskal's algorithm for Minimum Spanning Tree

- Adjacency list of the given graph is as follows:

a → b → c → d
b → a → c → d
c → a → b → d → p → q
d → a → b → c → p → q
q → d → p

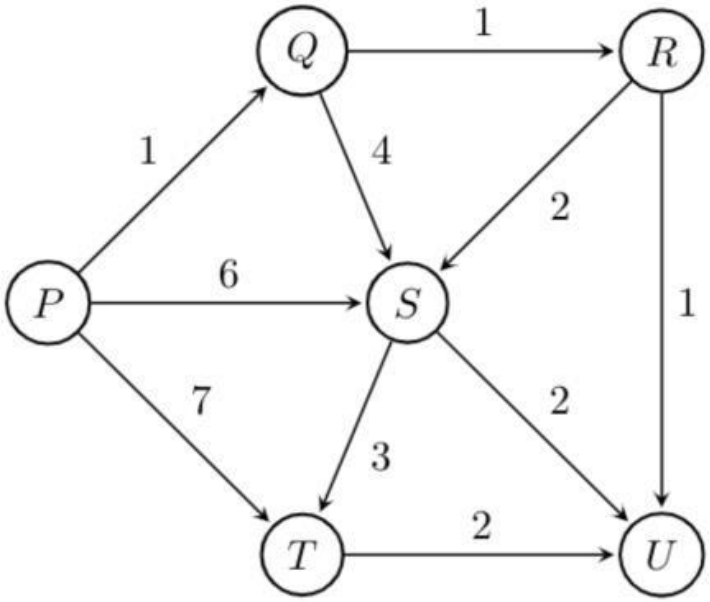
- The Cost of MST = 1+1+1+1+2=6
- The MST is not unique.

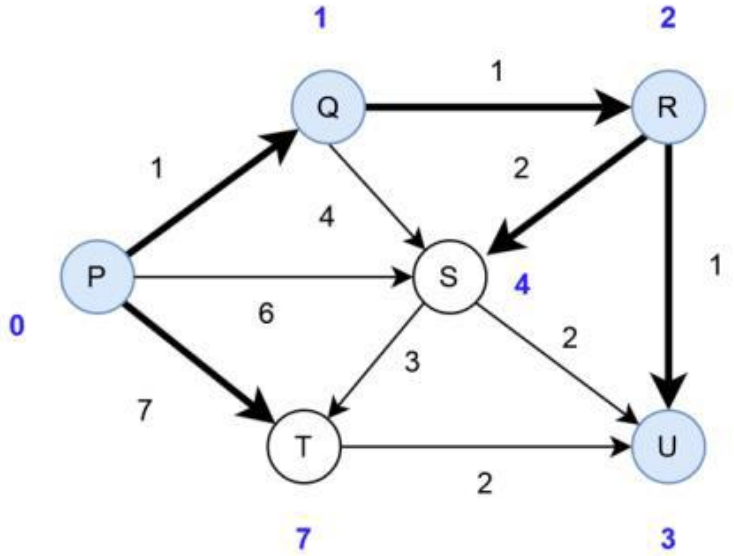
Sl. No.	Edge	Weight	Selection
1	(a, d)	1	√
2	(b, c)	1	√
3	(c, q)	1	√
4	(p, q)	1	√
5	(a, b)	2	√
6	(b, d)	2	x
7	(d, q)	2	x
8	(a, c)	3	x
9	(c, d)	3	x
10	(c, p)	3	x
11	(p, d)	3	x



Shortest Path

Use a shortest path algorithm to calculate the shortest paths from vertex P to all other vertices in the given graph. Show the data structure when vertex U is added to the shortest path.





Vertex	S	T
d	4	7


Each of your
actions will
have an
impact on your
future.


Once you know
who is walking
with you on your path.
you will never
be afraid.

Thank you