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Section:- E

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Subject:- DAA

Code:- TCS-SOS

Tut:- 07

Ans-1

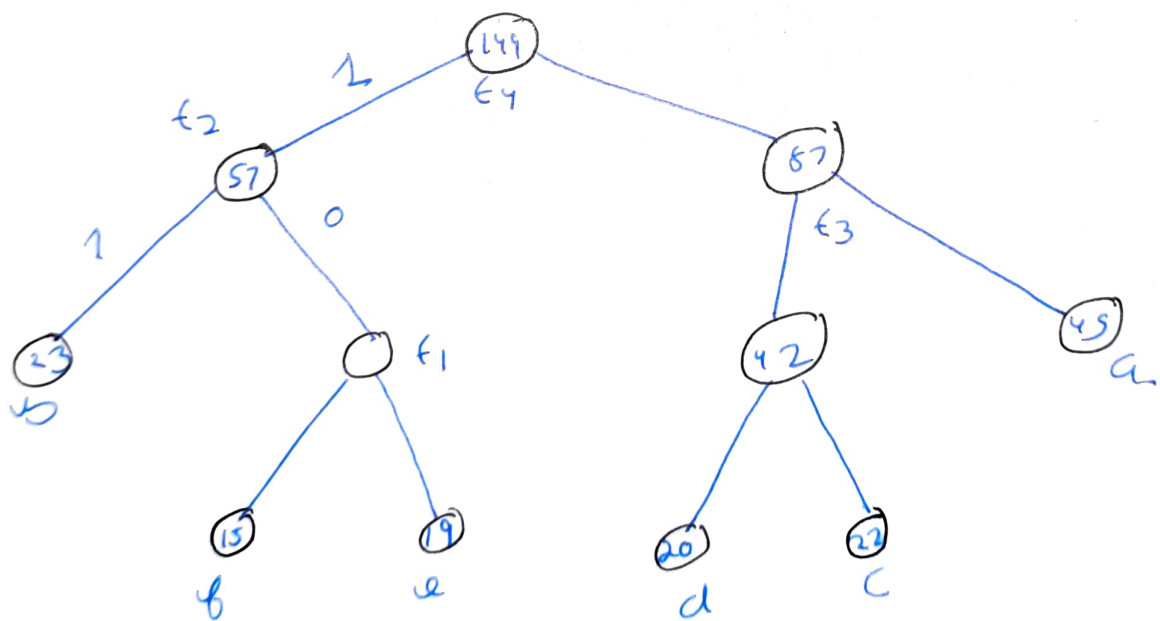
Greedy is an algorithmic paradigm that builds up a solution piece by piece, always choosing the next piece that offers the most obvious and immediate benefits. This means that it makes a locally optimal choice in the hope that this choice will lead to a globally optimal solution.

A problem must comprise these two components for a greedy algorithm to work:-

1. It has optimal substructures. The optimal solution for the problem contains optimal solutions to the subproblems.
2. It has a greedy property (hard to prove its correctness). If you make a choice that seems the best at that moment and solve the remaining subproblems later, you still reach an optimal solution. You will never have to reconsider your earlier choices.

Ans-2 Seq 0	(Time complexity) ↑ T.C	(Space complexity) ↑ S.C
Activity Selection	$O(n \log n) \rightarrow$ unsorted $O(n) \rightarrow$ sorted.	$O(1)$
Job Scheduling	$O(n^2)$  $O(n \log n)$ priority queue	$O(n)$
Fractional Knapsack	$O(n \log n)$	$O(1)$
Huffman encoding	$O(n \log n)$	$O(n)$

Ans-3



②

Letters	Huffman code.	Frequency	No. of bits.
		45	90
a	0 0		46
b	1 1	23	
c	0 1 0	22	66
d	0 1 1	26	60
e	1 0 0	19	57
f	1 0 1	15	45
		<u>144</u>	<u>364</u>

$$\text{Average length} = \frac{364}{144} = 2.52$$

Ans-7 Priority queue is used for building the Huffman tree such that nodes with lowest frequency have the highest priority. A min heap - data structure can be used to implement the functionality of a priority queue.

Applications:-

- Huffman encoding is widely used as compression formats like GZIP etc.
- Multimedia ~~codes~~ like JPEG, PNG and MP3 uses Huffman encoding.
- Huffman encoding still dominates the compression Industry.

Ans 5

Value	6	10	18	15	3	5	7
Weight	1	2	4	5	1	3	2
V/W	6	5	4.5	3	3	1.66	1

max weight = 15

$$\begin{aligned}\text{Weight} &= 6 + 10 + 18 + 15 + 3 + 1.66 \times 2 \\ &= 52 + 3 \times 33 = 55.33 \text{ units}\end{aligned}$$

Ans-6

In fractional knapsack problem the basic idea of the greedy approach is to calculate the ratio value / weight for each item and sort the items on basis of this ratio. Then take the items with the highest ratio and add them until we can't add the next time. as a whole and at the end add the next time as much as we can.

In Huffman encoding, the algorithm builds the tree. It analogous to the optimal code in a bottom up manner. It starts with a set of  $|C|$  leaves ( $C$  is the number of characters) and performs  $|C|-1$  merging operations to create the final tree.

Huffman's greedy algorithm uses a table of the frequencies of occurrence of each character to build up an optimal way of representing each character as a binary string.



Ans-7

start time	1	2	0	6	9	10
end time	3	5	7	8	11	12

③

max activities = 3 i.e.  $\textcircled{S}$  1 to 3,  $\textcircled{E}$  6 to 8,  $\textcircled{S}$  9 to 11

Ans-8

	a	b	c	d	e
Profit	20	15	10	5	1
Deadline	2	2	1	3	3

Max deadline = 3

$\therefore$  Maximum array size = 3

c	a	b
10	20	5

 $= 10 + 20 + 5 = 35$

Ans-9

Sometimes greedy algorithms fail to find the globally optimal solution because they do not consider all the data. The choice made by a greedy algorithm may depend on choices it has made so far, but it is not aware of future choices it could make.

eg-2  
~~like consider that the capacity~~

Ans-10 we can optimize the approach of solving Job sequencing problem by using Priority Queue. (max heap).

Algorithm:

- Sort the jobs based on their deadlines.
- Iterate from the end and calculate the available slot between every two consecutive deadlines. Include the profit, deadlines and job ID of its job in the max heap.
- While the slot are available and there are jobs left in the max heap, include the job ID with maximum profit and deadline in the result.
- Sort the result array based on the deadlines.