CS & IT ENGINEERING

Algorithms

Greedy Method

DPP 01 (Discussion Notes)

By- Aditya sir

[MCQ]

#Q. Consider the following statements.

S_1: The cost of the MCST obtained by prims and Kruskals will always be equal.

S_2: A minimum spanning tree can contain negative edges.

Choose the correct statements.

A. Only S_1 is true

B. Only S_2 is true

C. Both S_1 and S_2 are true

D. neither S_1 nor S_2 is true

Ans :- C

Soln :-

MCST

- Prim's
- Kruskal

} → Cost always same.

- Structure may or may not be same.

[MCQ]

MSQ

#Q. Which of the statement is/are correct?

Ans :- B, D

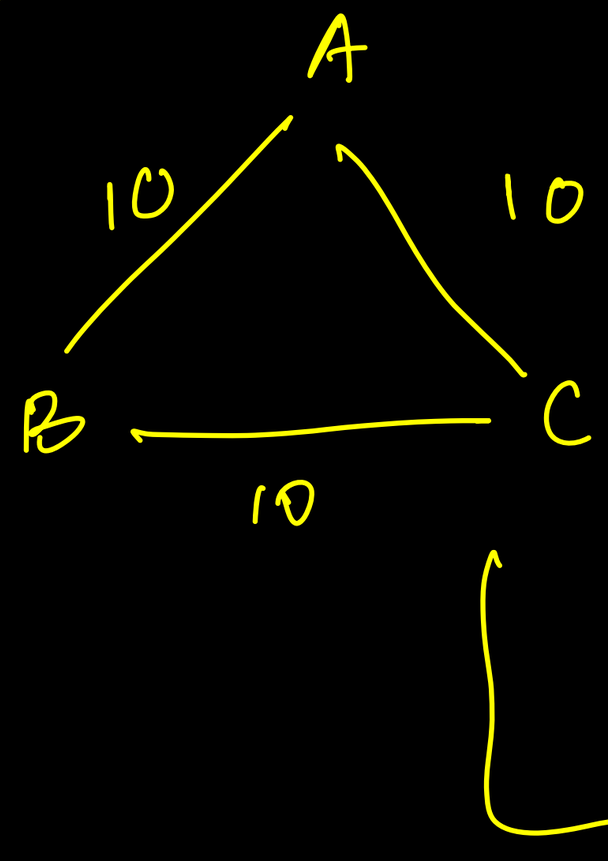
A. If there are duplicate weighted edges, the structure of the MCST obtained by both prims and kruskal will always be same. → False

B. In a graph, if one raises the length of all edge to the power of 3, the minimum spanning tree will stay the same. → True

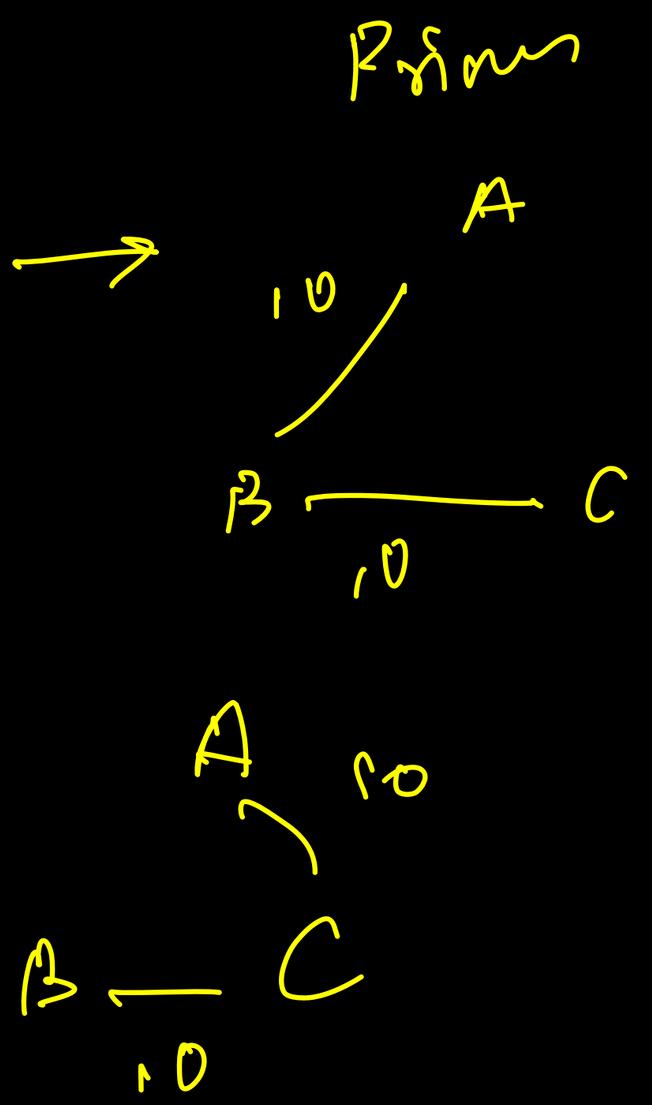
C. The heaviest edge in a graph cannot belong to the minimum spanning tree. False

D. The maximum spanning tree (spanning tree of maximum cost) can be computed by negating the cost of all the edges in the graph and then computing minimum spanning tree.

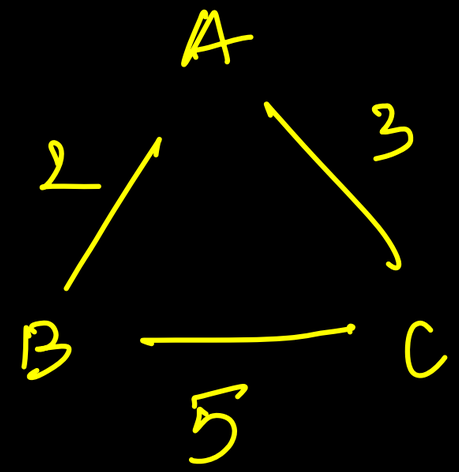
Q: (S1)

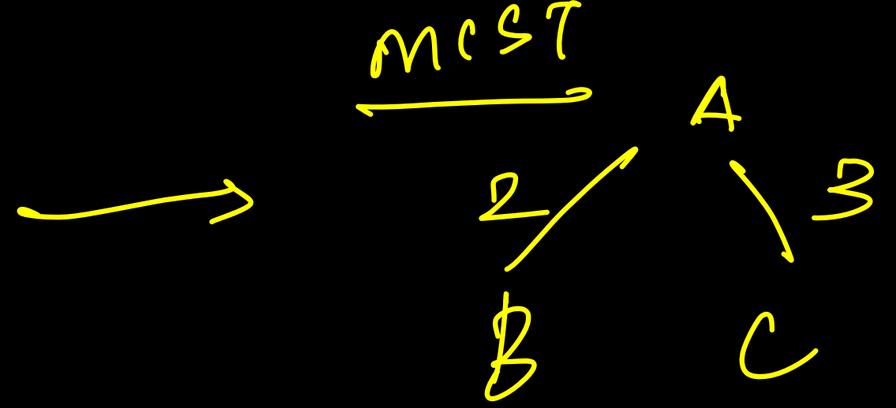


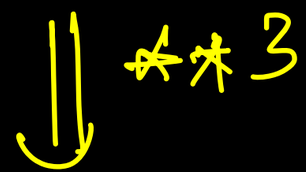
Prim's

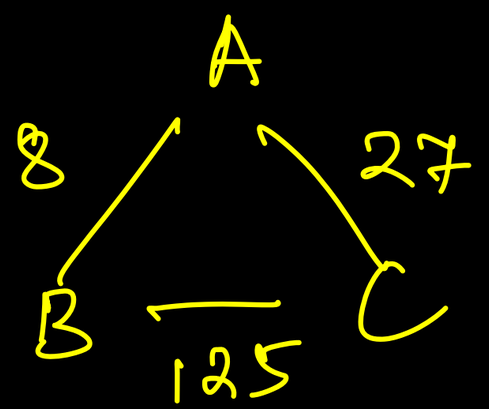


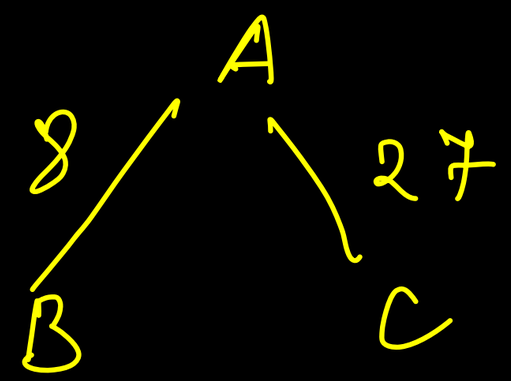
(B)



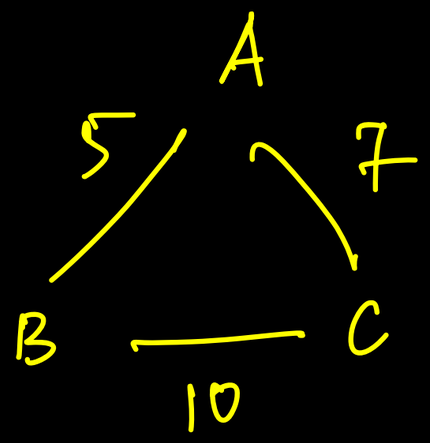






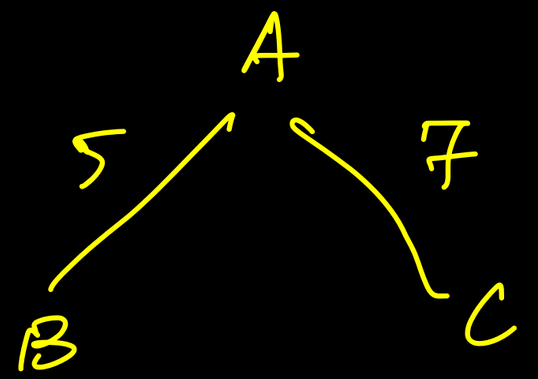


C

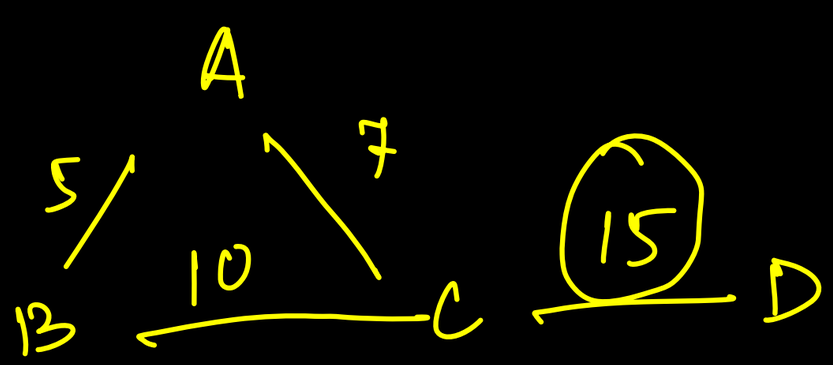


⇒

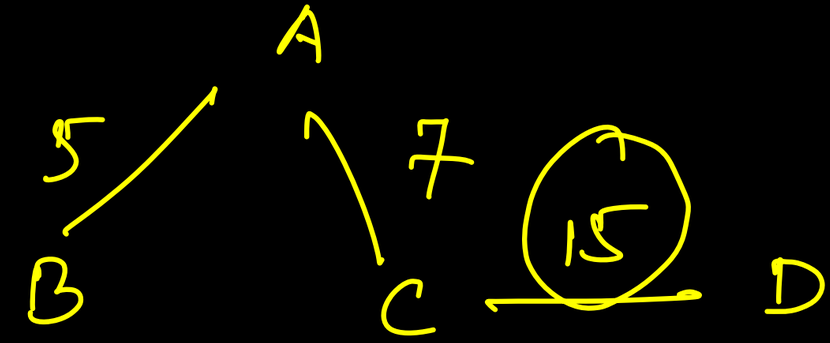
MCST

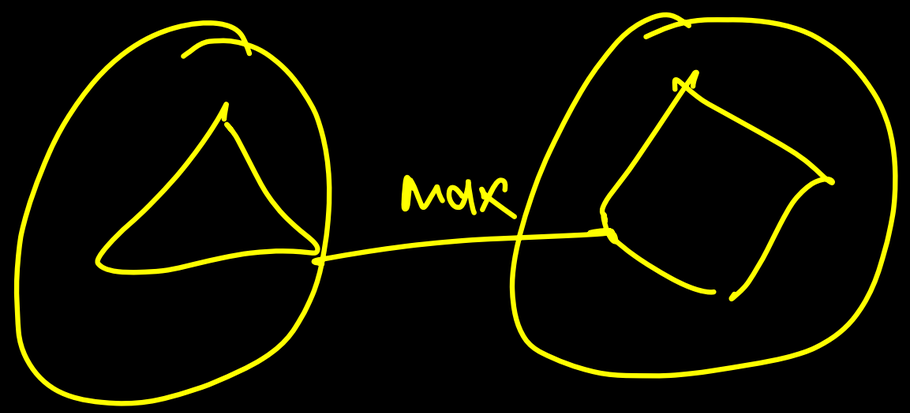


MCST

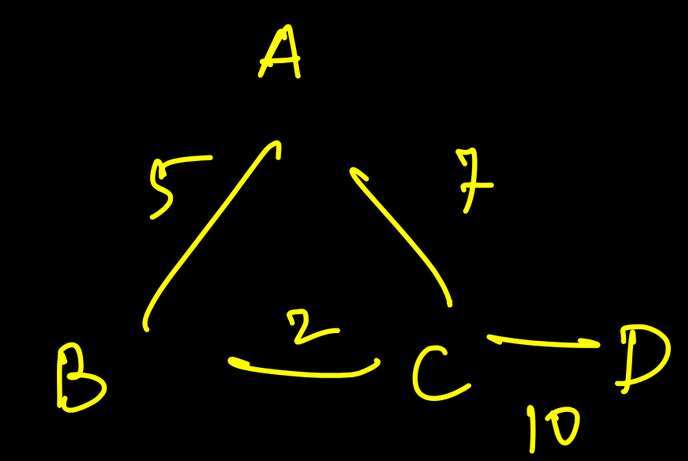


⇒



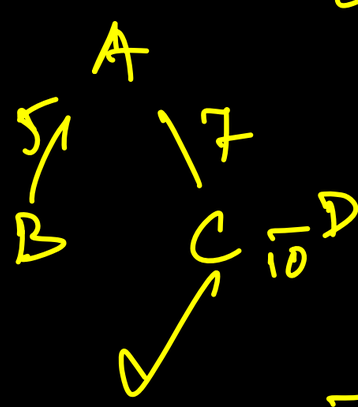


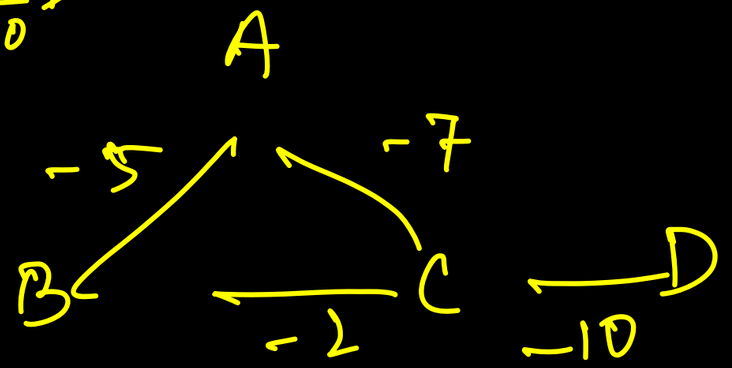
(D)



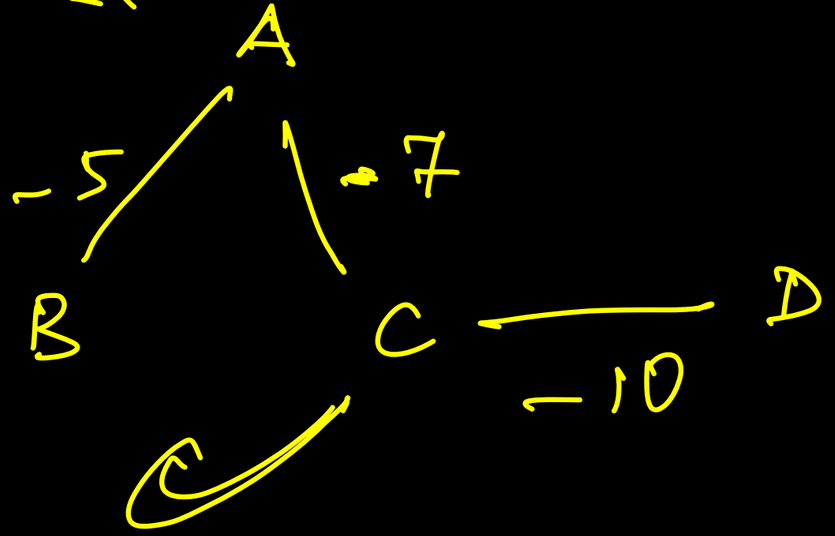
MCST

Min Cost Span Tree





Structure



[NAT]

#Q. Consider the following instances of the job for-scheduling problem with deadlines (Note: every Job takes one unit time)

Job	J1	J2	J3	J4	J5	J6	J7
Deadline	1	3	4	3	2	1	2
Profit	3	5	20	18	1	6	30

What is the maximum profit earned by greedy algorithm _____?

Optimal Soln

Ans: 74

$J_7 \rightarrow 30 \rightarrow 2$ — (1)

$J_2 \rightarrow 20 \rightarrow 4$ — (2)

$J_4 \rightarrow 18 \rightarrow 3$ — (3)

$J_6 \rightarrow 6 \rightarrow 1$ — (4)

$J_2 \rightarrow 5 \rightarrow 3$ — (5) ✗

$J_1 \rightarrow 3 \rightarrow 1$ — (6) ✗

$J_5 \rightarrow 1 \rightarrow 2$ — (7) ✗

max (4)

J_6	J_7	J_4	J_3
1	2	3	4

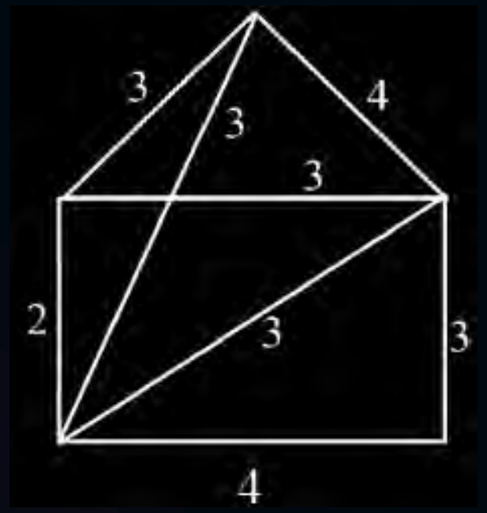
Total Profit

$= 30 + 20 + 18 + 6$

$= 74$

[NAT]

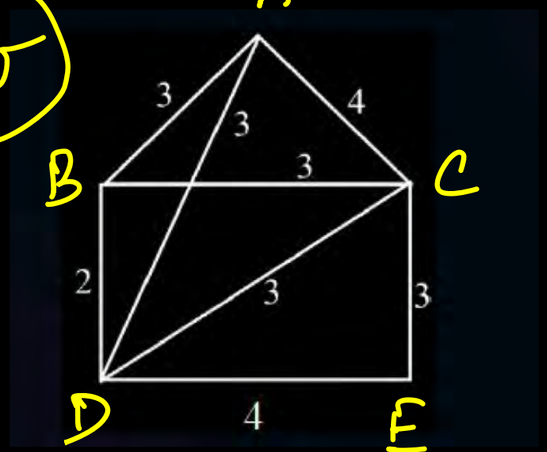
#Q. Consider is the weighted graph G given by



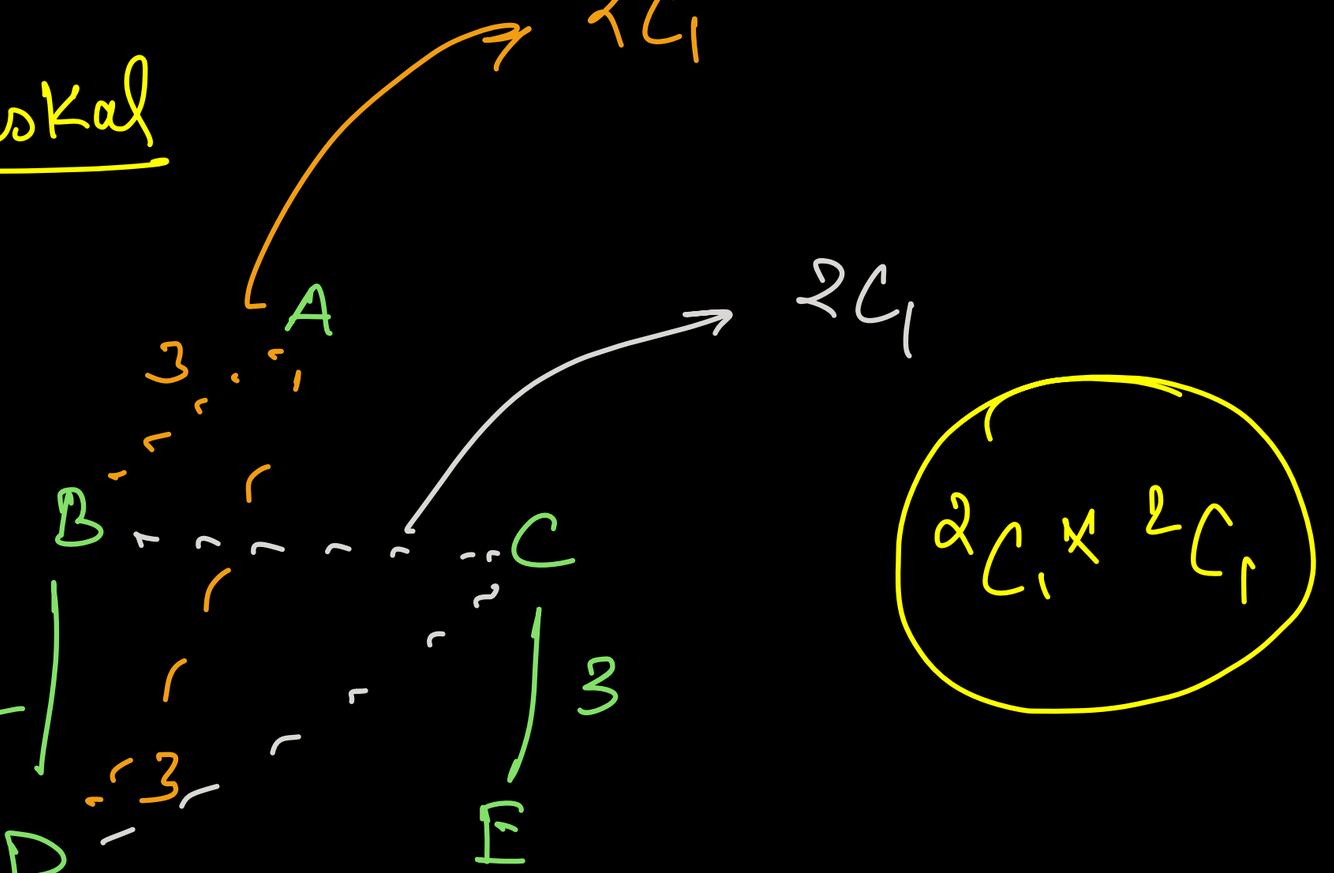
How many MST does G Have?

Ans :- 4

(G)



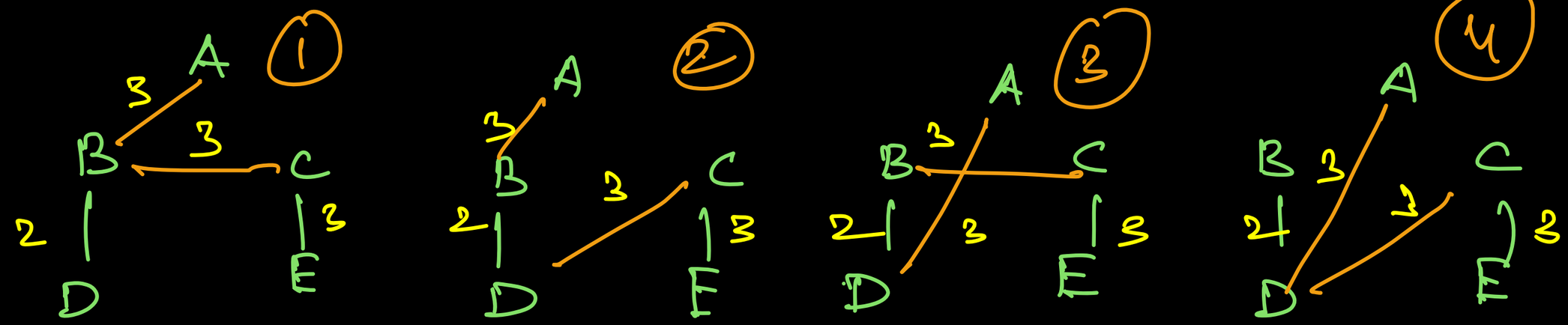
⇒ Kruskal



n = 5

e = 5-1 = 4 ✓

MCST



[MCQ]

#Q. Let's suppose, we want to merge some sorted files where the number of records in each file is given below.(15, 18, 20, 21, 24, 28, 30, 32, 35, 40, 45, 50) then what is the minimum number of comparisons required to merge the following files?

A 1200

B 1225

C 1251

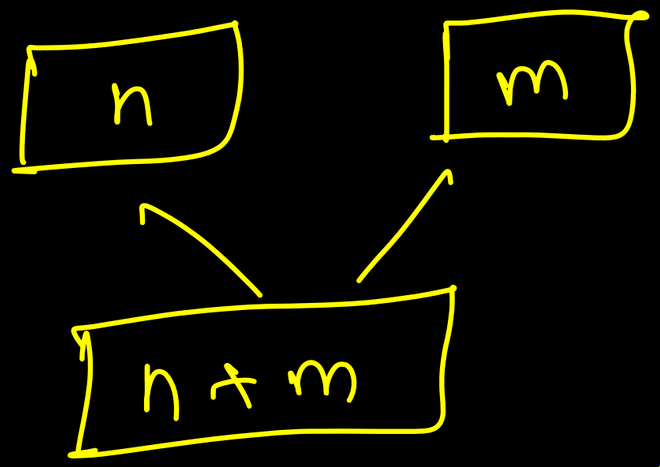
D 1255

When 2 files are merged at a time.

By default :- w.c of Best Possible Algo

Ans: C

2-way merging



① Record Movements

always (m + n) ✓

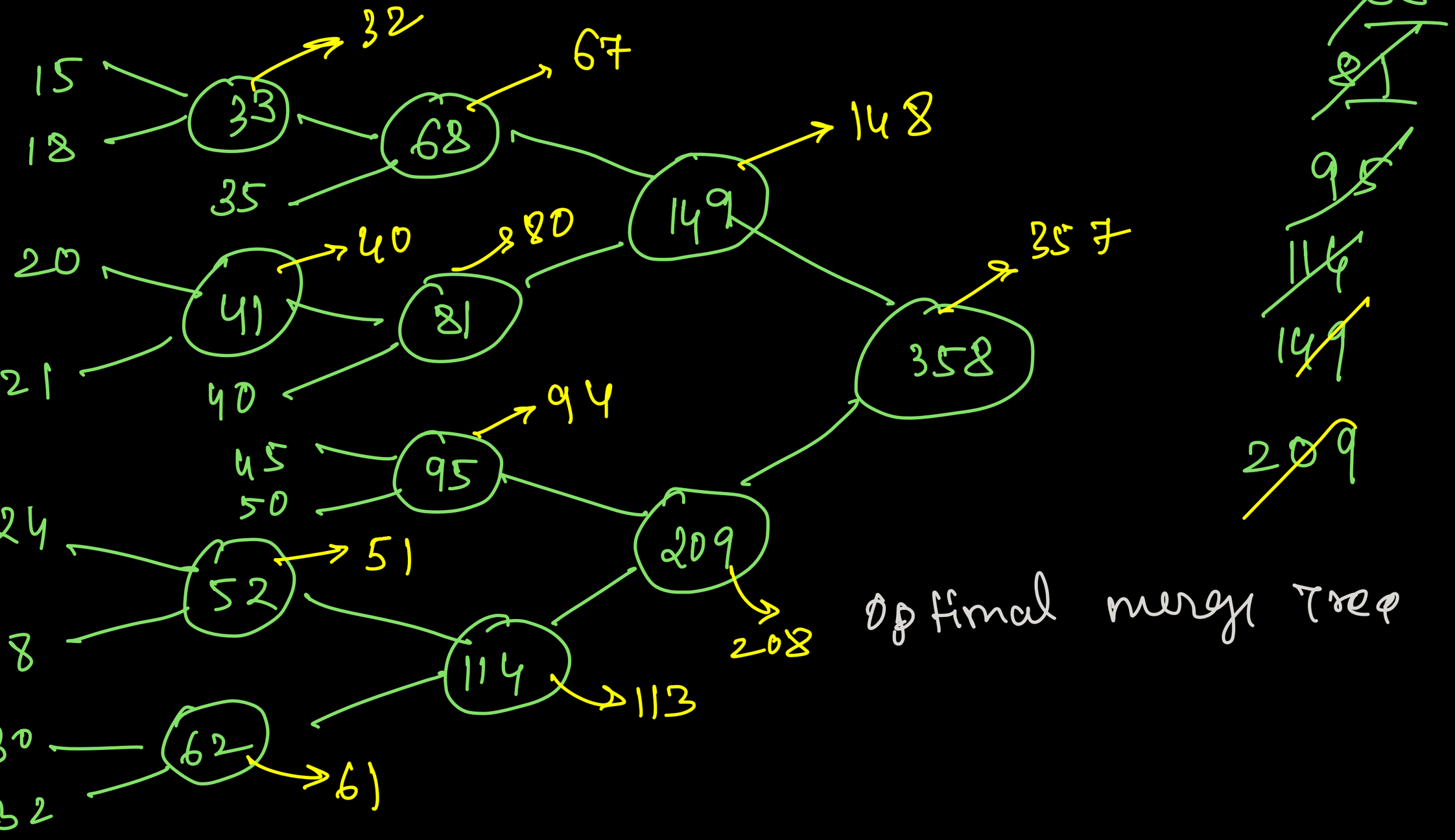
② Comparisons

Optimal merge pattern ⟹

a) B.C : min(m, n)

b) W.C : m + n - 1

15, 18, 20, 21, 24, 28, 30, 32, 33, 35, 40, 45, 50, 52, 67



Optimal merge tree

Total no. of Comparisons

$= 32 + 40 + 51 + 61 + 67 + 80 + 94$

$+ 113 + 148 + 208 + 357$

$= \boxed{1251}$ ✓

[MCQ]

#Q. Greedy algorithm fails to give an optimal solution to which of the following problems?

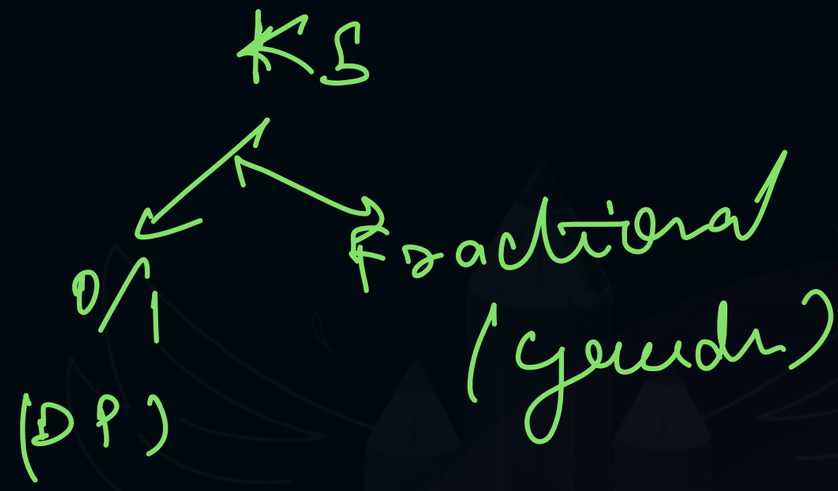
(p) Travelling salesman problem → DP

(q) Merge Sort → DnC

(r) Binary Knapsack Problem → DP

(s) optimal merge pattern → g

(t) Huffman encoding → g



A. p, q, r

B. r, s, t

C. p, q, r, s, t

D. All of the above

Ans. : A

[MCQ]

#Q. Consider the following graph G:

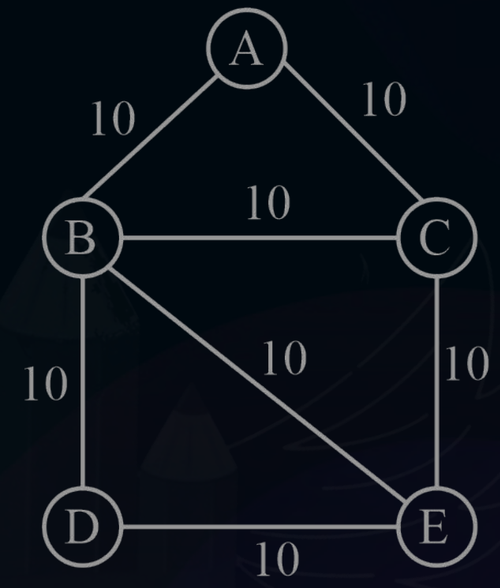
How many MST (minimum spanning tree) possible for above graph G?

A 5

B 11

C 21

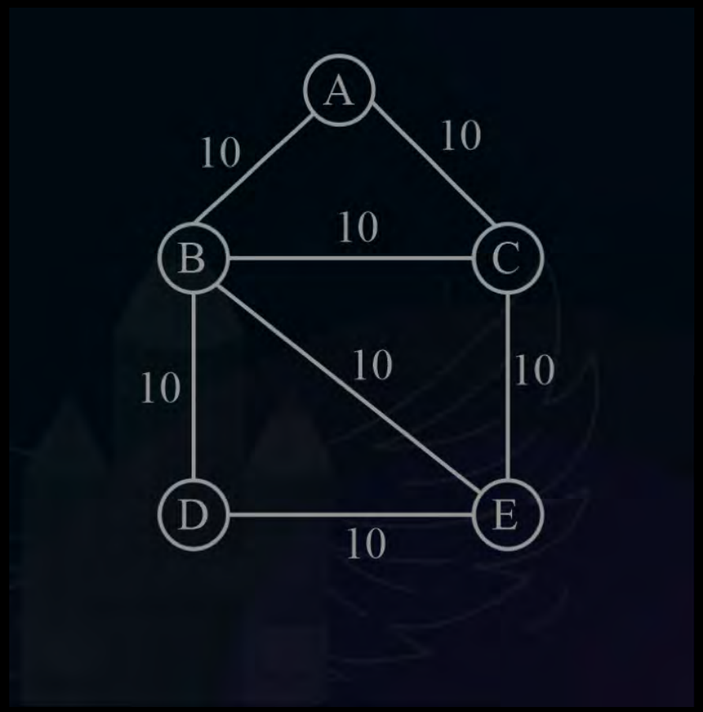
D 17

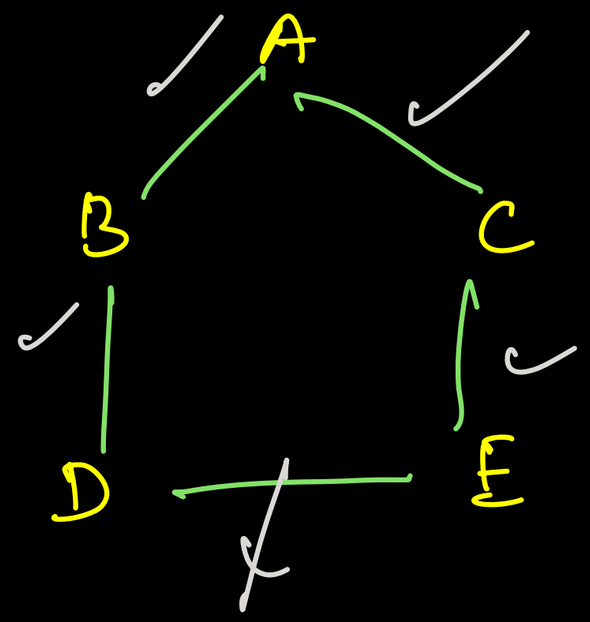


Ans : C

5 vertices

4 edges.





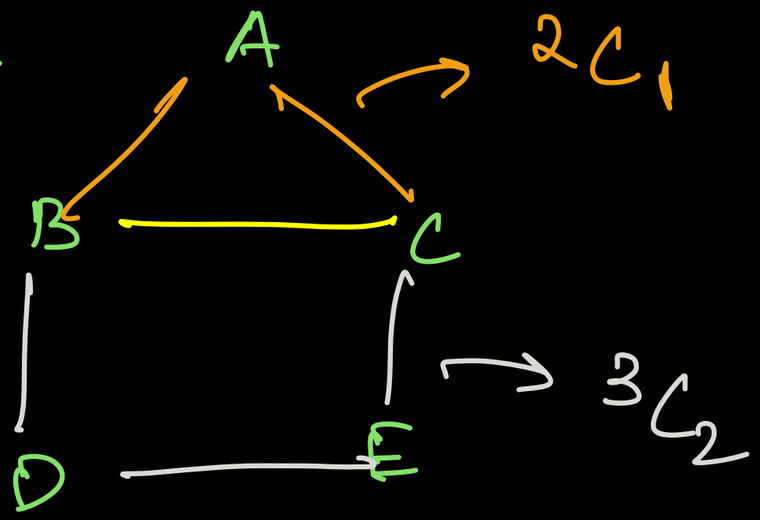
Case ①

BC ✓

BE ✗

MCST = 5

Case 2 :-



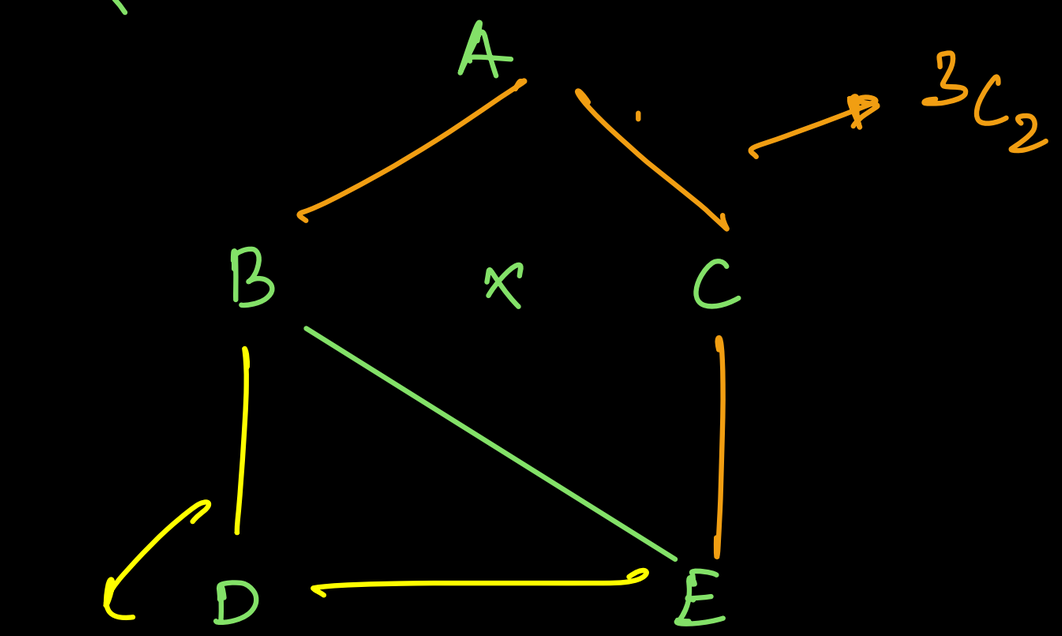
BC ✓

BE ✗

Total MCSTs : $^2C_1 \times {}^3C_2$

$= 2 \times 3 = 6$ MCSTs

Case 3 :-



BCX

BE ✓

$^2C_1$

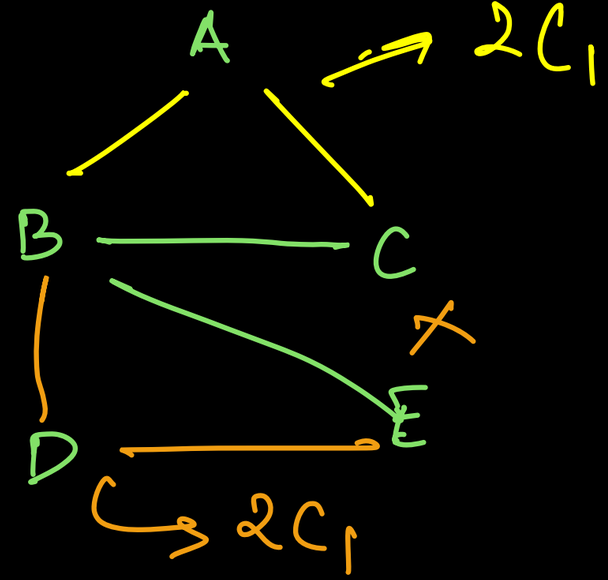
Total MCSTs

$= {}^3C_2 \times {}^2C_1$

$= 3 \times 2$

$= 6$ ✓ MCSTs

Case 4 :-



BC ✓

BE ✓

Total MCSTs

$= {}^2C_1 \times {}^2C_1$

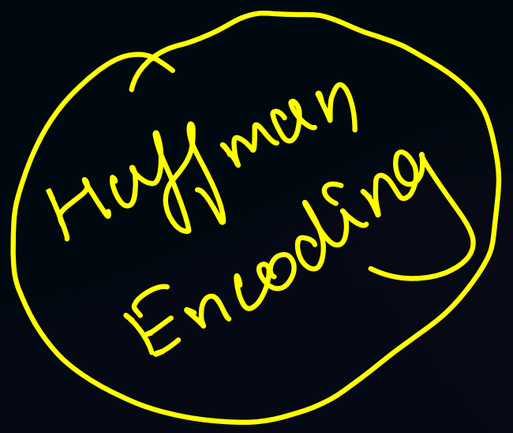
$= 4$ ✓

Total MCST$_L$ = $5 + 6 + 6 + 4$

$= 21$

[NAT]

#Q. A message is made up of the characters J, K, L,M and O with the probability given below.



Character	Probability
J	0.20
K	0.32
L	0.38
M	0.04
N	0.06

Ans : 2.02

What is the average length by using optimal coding technique ? ___ [upto 2 decimal places]

Soln :-

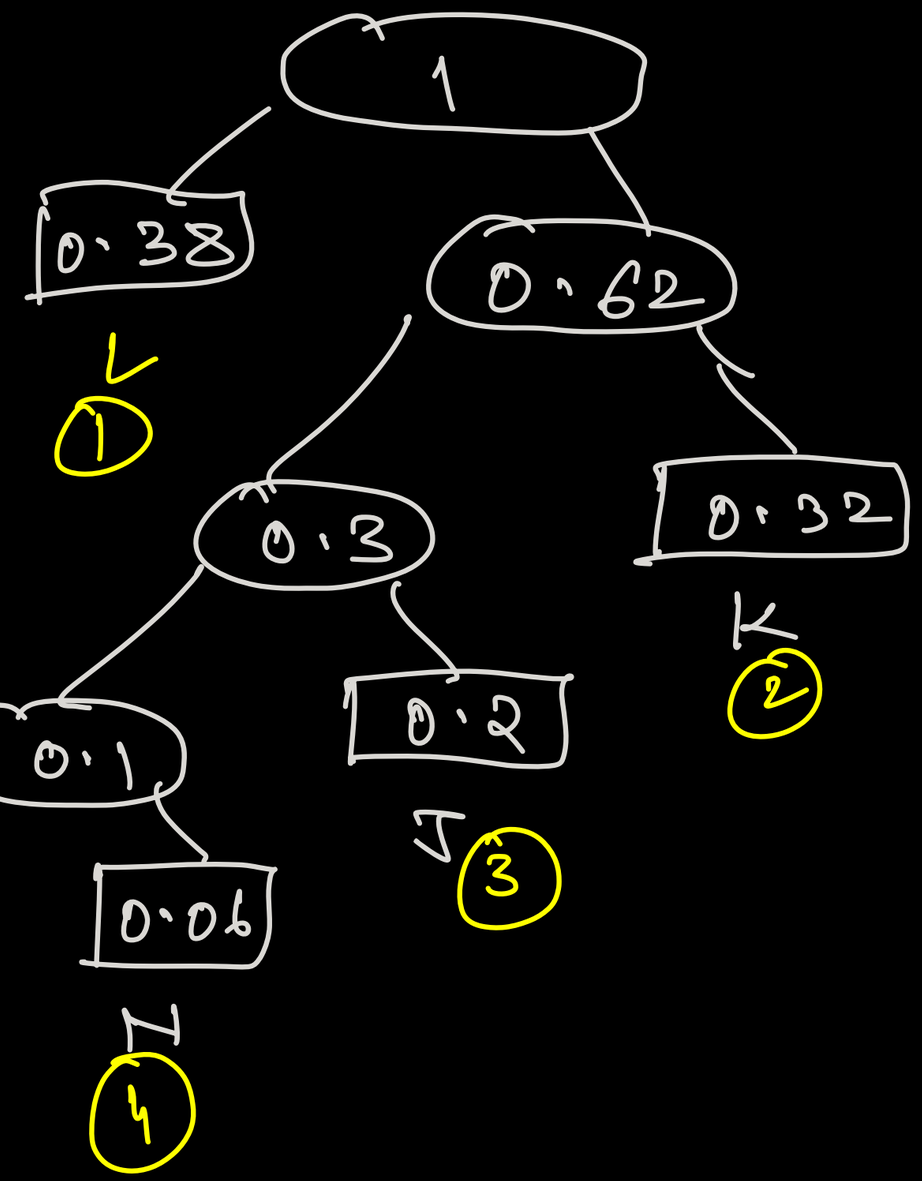
M → 0.04 — 1

N → 0.06 — 2

J → 0.2 — 3

K → 0.32 — 4

L → 0.38 — 5



Avg no. of bits/char

$= \sum d_i * q_i =$

$$= 0.38 \times 1 + 0.32 \times 2 + 0.2 \times 3 + 0.04 \times 4$$

$$+ 0.06 \times 4$$

$$= 0.38 + 0.64 + 0.6 + 0.16 + 0.24$$

$$= 0.38 + 1.24 + 0.4$$

$$= 0.78 + 1.24$$

$$= \boxed{2.02}$$

Sum of internal nodes

[MSQ]

#Q. Which of the following is/are application of greedy technique?

A. Bellman ford algorithm → DP ✗

B. Kruskal algorithm → Greedy ✓

C. Longest common subsequence (LCS) → DP ✗

D. Sum of subset problem. (SOS) → DP ✗

Ans :- B

THANK - YOU