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CSE: 4403

Ans to the question no-1(a)

As it is english letter let's assume it we will calculate it with 26

WOW TENET-20
23 15 23 20 5 15

$$T = (20 \times 17^0) \% 1327$$

$$P = 1307$$

$$E = (5 \times 17^1) \% 1327 = 1472$$

$$N = (15 \times 17^2) \% 1327 = 324$$

$$E = (5 \times 17^3) \% 1327 = 669$$

$$T = (20 \times 17^4) \% 1327 = 1054$$

$$W = (23 \times 17^5) \% 1327 = 567568$$

$$O = (20 \times 17^6) \% 1327 = 874$$

$$W = (23 \times 17^7) \% 1327 = 931$$

A = 1	<u>O = 15</u>
B = 2	P = 16
C = 3	Q = 17
D = 4	R = 18
<u>E = 5</u>	S = 19
F = 6	<u>T = 20</u>
G = 7	U = 21
H = 8	V = 22
I = 9	<u>W = 23</u>
J = 10	X = 24
K = 11	Y = 25
L = 12	Z = 26
M = 13	
<u>N = 14</u>	

Now according to the matching pattern string hash value will be calculated. According to the length sum will be done if hash value same again check with character for security and . If match string , match found

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Ans to the question no. 1(b)

So the idea is we have the hash value of single character. If any two or more same value match index will be stored. Same hash value found on not that will be seen with help of hash map. Then select block calculate hash and reverse hash if both are same, we found palindrome. For example here,

WOWTENET \rightarrow we will know repeat in
 $0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 100$

Starting from highest gap $(7-3)=4$. So now calculate hash value.

(1st time as normal) T E N E T
 $T \times 17^4 + E \times 17^3 + N \times 17^2 + E \times 17^1 + T \times 17^0$

(2nd time reverse) T E N E T
 $T \times 17^0 + E \times 17^1 + N \times 17^2 + E \times 17^3 + T \times 17^4$

The main trick is Changing base power if hash value same. we found palindrome. If not same go to next highest seqⁿ. Go until all repeat seqⁿ finish. If no same hash found no palindrome.

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Ans to the question no 1(a)

We can use z algorithm.

Additionally we have to found if that is suffix or not it means that if ~~here~~ z number don't reach at the end it cannot be the answer. At first we will start from highest z number. For example

~~a a b c d e a a x a a b~~
0 1 2 3 4 5 6 7 8 9 10 11 12
a a b d x a a b d y a a b → Here z value
0 1 0 0 0 4 1 0 0 0 3 1 0 ←

Here we start checking from 4 means 5th index but $4-1=3$ and $5+3=8$. 8 is not equal to string length so it is not suffix.

Next we move on to $4-1=3$ it is at 10th index and $3-1=2$ and $10+2=12$ which is the length of the string so that's the answer.

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To find the highest ordering z value is not needed.

Here all z value will be in an z array. Then only be one checking will do the work here. Just save the highest z value that fulfilled the suffix condition.

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Ans to the question no. 2(a)

To find the minimum spanning tree the steps are:

② Here I use Kruskal

① First sort the weight of the edge

~~First sort the weight of the edge~~
~~Then use Kruskal~~
~~algorithm~~

①

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Here,

3, 5, 8, 8, 15, 16, 32, 64

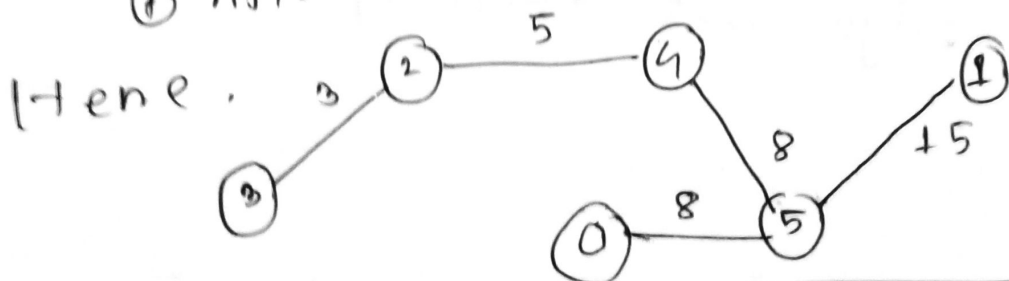
- ① Initial all parent with (-1)
- ② Then starting from the lowest edge.
Before adding new one

① check parent of the vertices that should connect through that edge has the same parent or not with source vertices.

If same it means that vertices are already connected. So skip.

② We also cannot use cycle for that above dsu parent check is needed before add.

③ After adding make parent same.



① When all vertices connect we can stop if we know the number of vertices before

② If all vertices not reach edge value end \rightarrow Impossible vertices

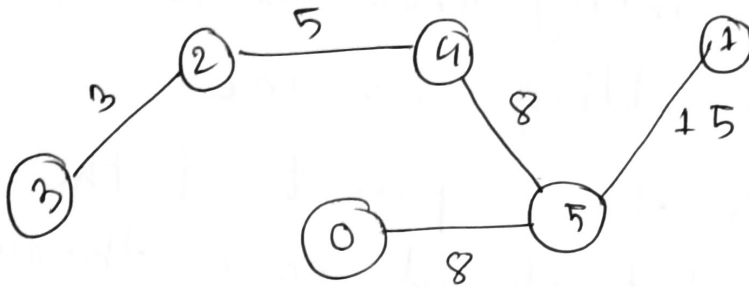
16, 32, 64 will not be added because 4 and 1 are connected before, that can be found.

⑥

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Ans to the question no - 2(b)

From q(2)(a) we know the MST is



Here cost is,

$$3 + 5 + 8 + 8 + 15 = 39$$

The main thing is that we will try to build minimum spanning tree without the edge. If the cost is same it means that edge is not critical. But if cost increases it means the edge was critical.

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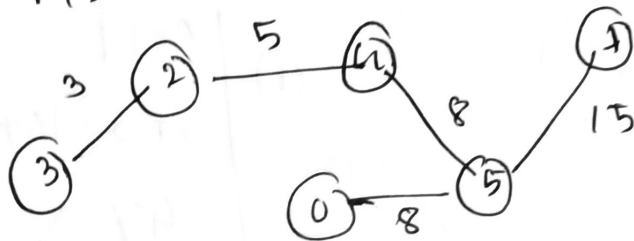
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(i) $0 \leftrightarrow 2$ (16)

without it the edge cost are

~~3, 5, 8, 8, 15, 32, 6~~
3, 5, 8, 8, 15, 16, 32, 64

MST



Cost =

$$3 + 5 + 8 + 8 + 15 = 39$$

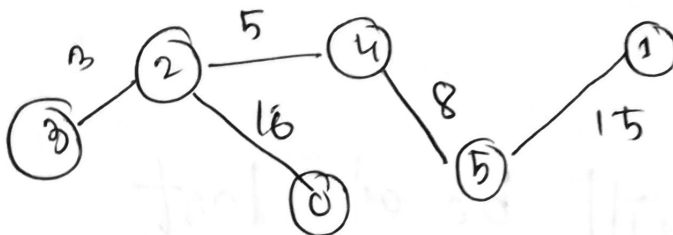
Same. So

not critical

(ii) $0 \leftrightarrow 5$ (8)

edge value

~~3, 5, 8, 8, 15, 16, 32, 64~~



cost

$$3 + 5 + 8 + 16 + 15$$

$$\Rightarrow 47 > 39 \text{ so}$$

critical

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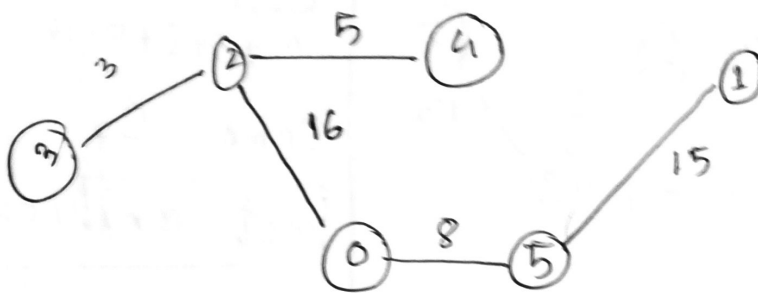
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(iii) 4-5 (8)
edge value

~~3+5+8+8+1~~

3, 5, 8, 8, 15, 16, 32, 64

MST



cost

$3+5+16+8+15$

$= 47 > 39$

Critical

← x →

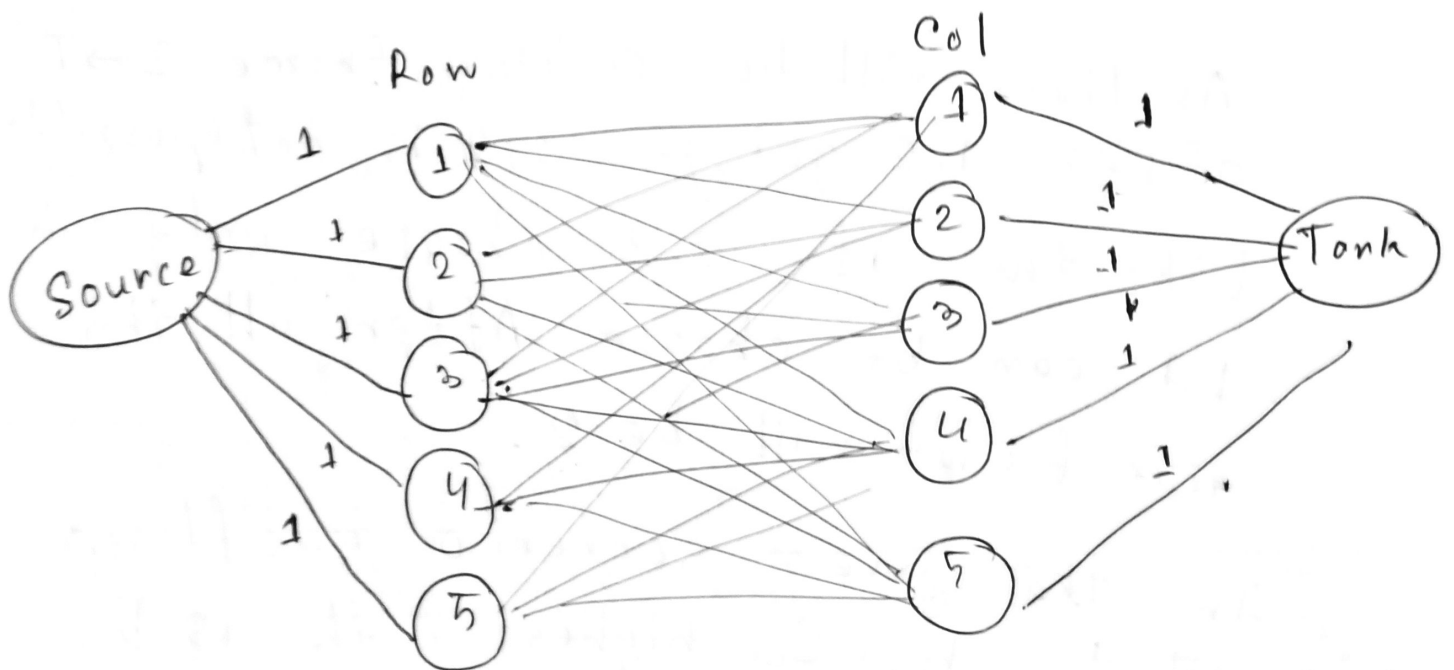
2(c) will be at last

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Ans to the question no-3

The rule is simple. One is row another column make it connected with ^{super} source and sink. Max flow will be the rank. For example here.
5 row, 5 col

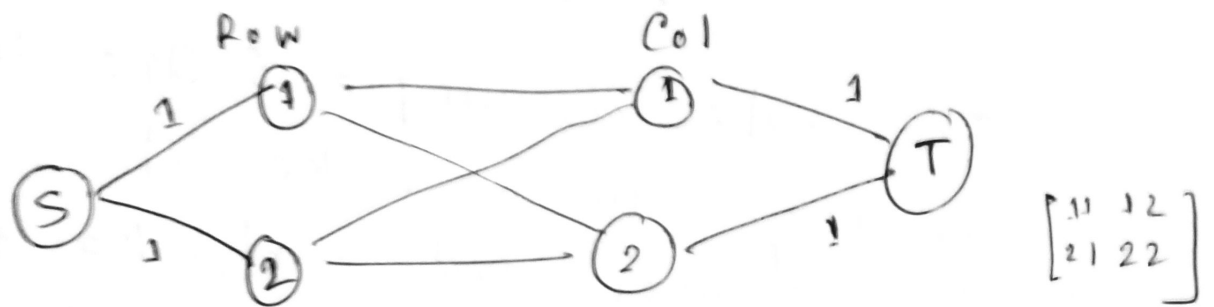


Row and col will be connected to each other.
Why this works let's simulate with a smaller $[2, 2]$ matrix

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For (2,2) Matrix algorithm will be



for See if we choose
Row 1 and Col 2 we have other
Row 2 and Col 1

As there will be 0 flow from 2 \rightarrow T
after 1, 2 going. 2, 2 is not possible.
Like this if 2, 2 choose only other
1, 1 can be choose. After all this
max flow will be 2.

In the given scenario max flow
will be 5. So highest rank is 5.

If col and row interchanged
in bipartite graph. It also works

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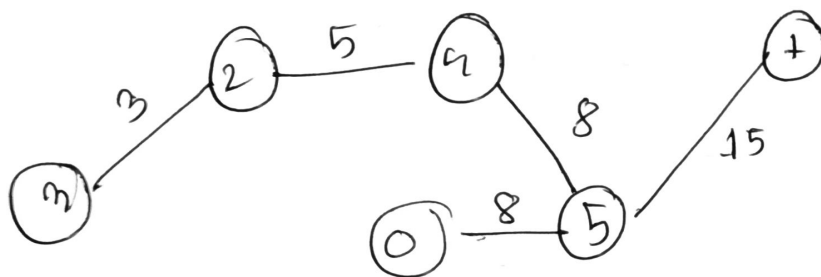
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Ans to the question no. 2c)

So the basic difference in product will happen in case of odd.

Here



Here single MST is possible. So it should be same as product tree.

So as there are no negative weights all the time it will be same, because product is actually another version of SUM. When we sort if high value pickup sum and product both will increase and in both MST and MPST it should be same. And Invalid.