



THE ANNUAL TECHNICAL FEST OF ELECTRONICS ENGINEERING DEPARTMENT OF IIT (BHU)

# UDYAM'21

# DIGISIM

## PROBLEM STATEMENT

### ROUND 2

Recently we have seen huge surge in the petrol prices. Smriti being a middle-class woman, wants to buy the fuel at the cheapest price. She observed that petrol is offered at different prices in different cities and she can buy from any city of her choice. Her total expense would also include transportation charges between her home city and the chosen city i.e., if she decided to buy from city X, her total expense would be:

$$\text{Expense}(X) = \text{price}(X) + \text{tpc} * \text{distance}(X)$$

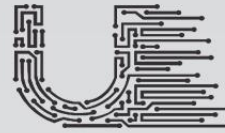
Where  $\text{price}(X)$  is price of fuel in city X

$\text{tpc}$  is a number/factor

$\text{distance}(X)$  = distance between her current city and city X

i.e., if X is neighboring city for Smriti,  $\Rightarrow \text{distance}(X) = 1$





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Read the value of tpc (transportation charge between neighboring cities) as a 8 bit number through logic states and the data about fuel prices as a binary file in ROM. You have to help Smriti find the city, from where she could buy fuel by spending the minimum amount.

Display the address of the required city and the overall amount she has to spend to get the fuel.

## TASK DESCRIPTION

The data will be stored in ROM in form of a binary tree.

Smriti's home city is the root of the tree.

The root of the tree will be at address 0.

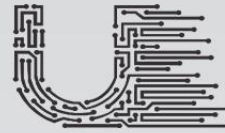
A node at address 'n' represents following information:

- i) Data of current node at address 'n'
- ii) Address of left child at address 'n+1'
- iii) Address of right child at address 'n+2'

If a child does not exist, it's address is denoted by '255'

The values in all three fields (data, addresses) can be between 0-255





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There is no overlapping of nodes.

The node represents the city and the data represents the petrol price in that city.

Distance between two cities is calculated as number of edges joining their nodes.

It is guaranteed that  $\text{expense}(X) \leq 255$  for all cities.

If more than one solution exists, you have to select the one which is closer to her city.

If still more than one solution exists, you can select anyone.

There cannot be more than 16 nodes in the tree.

## EXAMPLE

Address of current node (n)	(n+1)	(n+2)
Data of current node	Address of left child	Address of right child

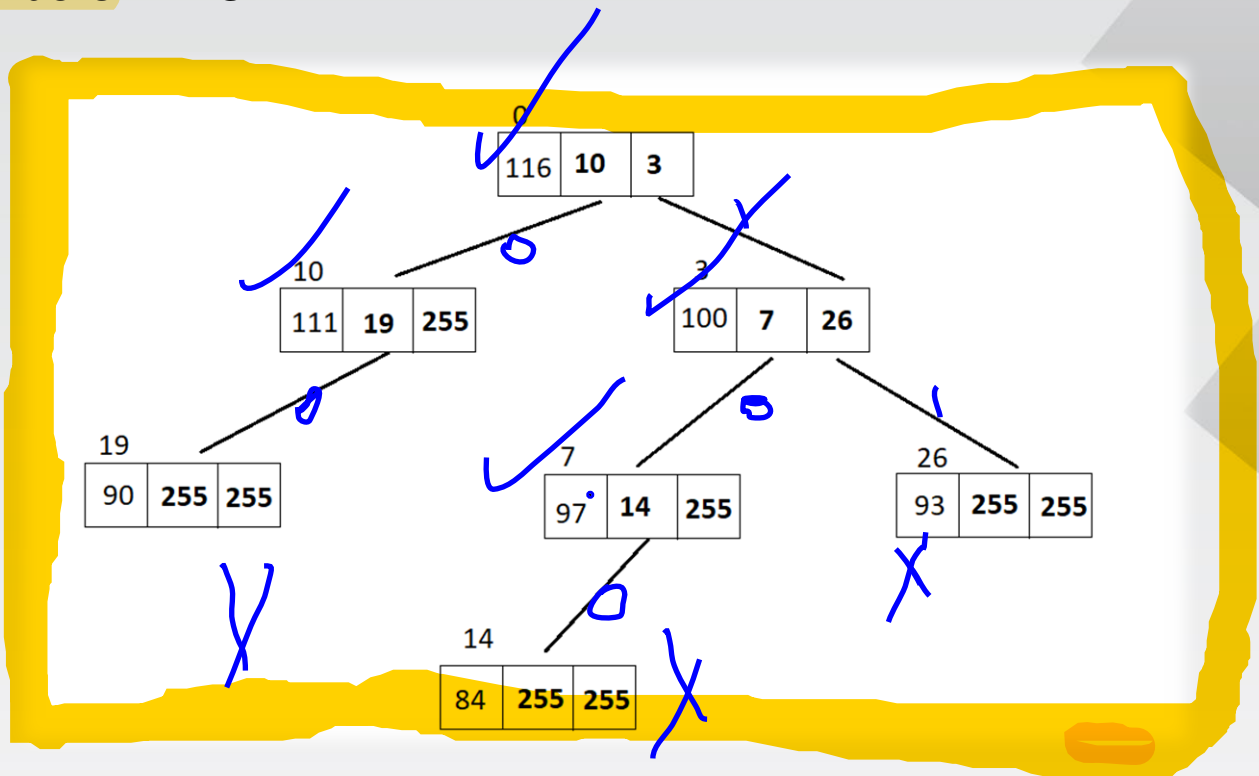




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This binary tree will be denoted by the following sequence of numbers in ROM



116,10,3,100,7,26,55,97,14,255,111,19,255,68,84,255,255,177  
,81,90,255,255,2,3,4,5,93,255,255,9,9



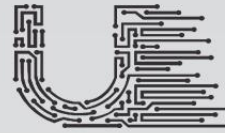
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if tpc = 12, expense = 112 and address = 3

9461k

Address of city X	Price(X)	tpc * distance(X)	Expense(X)
0	116	0	116
10	111	12	123
<b>3</b>	<b>100</b>	<b>12</b>	<b>112</b>
19	90	24	114
7	97	24	121
26	93	24	117
14	84	36	120

If tpc = 3, expense = 93 and address = 14

Address of city X	Price(X)	tpc * distance(X)	Expense(X)
0	116	0	116
10	111	3	114
3	100	3	103
19	90	6	96
7	97	6	103
26	93	6	99
<b>14</b>	<b>84</b>	<b>9</b>	<b>93</b>





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## List of components allowed

ROM (2732)

Comparator (7485)

Register (74179/74194)

Adder (74283)

Multiplexer (74157/74153)

Counter (74LS590, 74161, 74163, 74LS169)

Decoder (74LS139/74HC154)

Encoder (74HC148)

Buffer (74HC241/74125)

Flip flops (74273/7474, 74LS175, 74LS109)

BCD to 7 segment decoder (74LS347/7448)

7 segment/BCD display

Logic Gates

Clock



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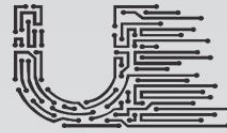


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IC	COST
ROM(2732)	50
Clock	20
7485, 74283, 74157, 74153, 74179, 74194, 74273, 74161, 74163, 74LS590, 74LS169, 74HC154, 74HC241, 74LS175, 7448, 74LS347	2
74LS139, 74HC148, 7474, 74LS109	1
Logic gates, 74125	0.1
Logic states, Logic probes	Free

## Scoring

- Submissions are accepted till 17<sup>th</sup> April 12:00 noon .
- Submit the simulation file (named <team\_name>) along with the explanation of your approach on google form floated on the whatsapp group.
- 1000 points will be awarded to the team on completing the PS.
- Total cost of the circuit will be deducted from the score.





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- Bonus marks (max 200) will be given based on following factors:

1. Time taken for submission
2. Addition of some innovative features
3. Readability/Clarity of circuit and its labelling
4. Technical complexity/efficiency
5. Structure and reusability

## General Rules:

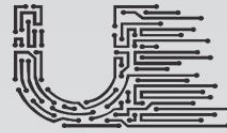
- The organizers reserve the right to change the rules as they deem fit. Change in rules, if any, will be notified on the WhatsApp group.
- The decision of the organizers shall be final and binding.
- **In case of any type of cheating/plagiarism suspected, the team will be immediately disqualified and no certificate will be given.**

## Round Rules:

- If multiple ROM(s) are used all of them shall be fed with the same binary file.
- Simulations based on components other than specified will not be accepted.
- Only Proteus simulation file will be accepted in this Round.







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## Certification Policy:

- The top three teams will be awarded a certificate of excellence.
- All teams qualifying the first round will be awarded a certificate of participation.
- Disqualified teams will not be considered for any certificates

## Contact:

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