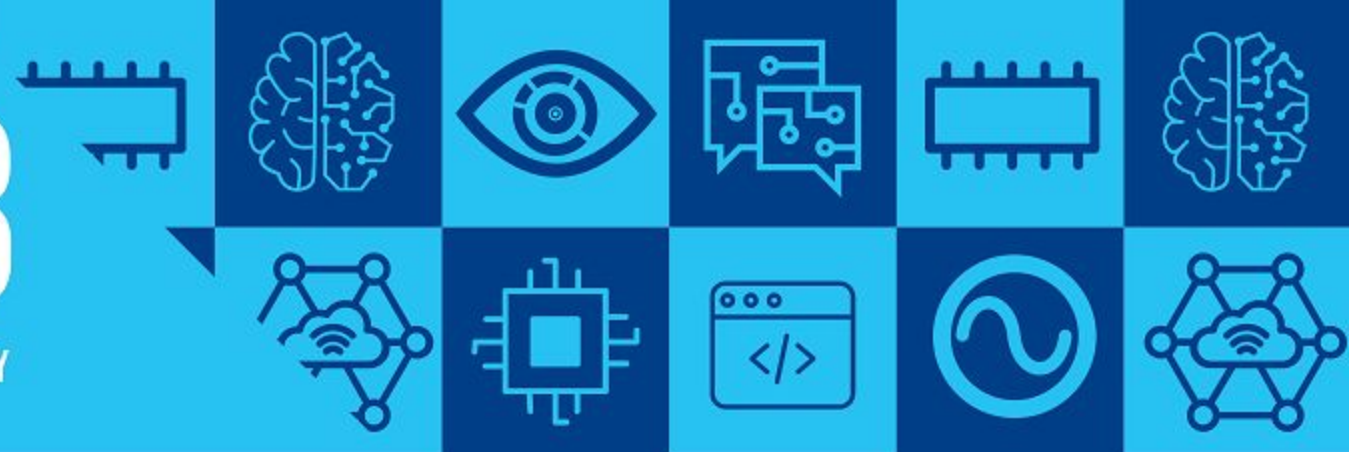




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ROUND-1

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The government is trying hard to make Varanasi a smart city. As we all are aware, traffic is a big problem here. The government also does not want to reconstruct buildings to make wider roads. The traffic department is not collecting data about traffic at the busiest square of the city, the Godowlia Square.

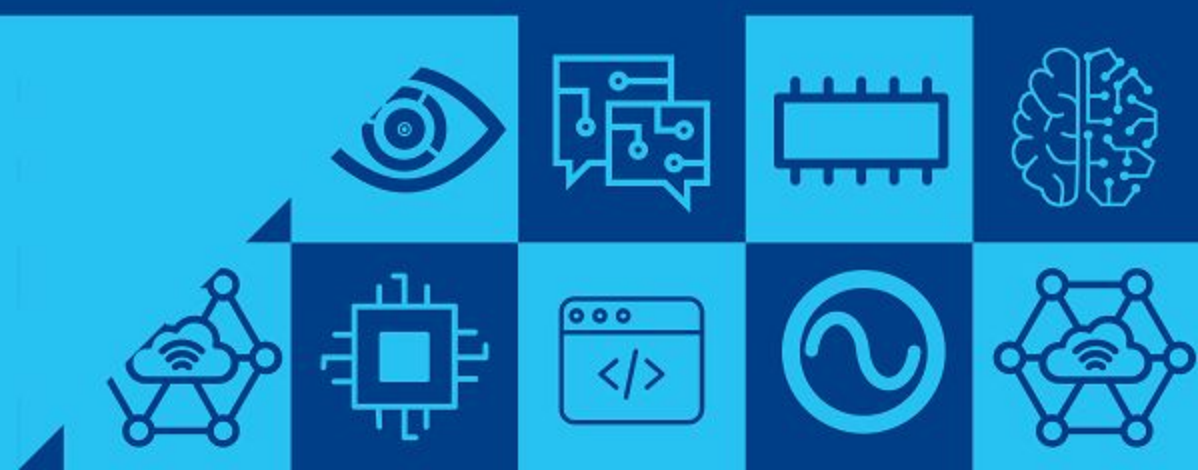
The government has deployed smart imaging systems which keep an eye on the traffic and tabulate the data into 2-wheelers, cars, commercial vans, heavy vehicles, trucks etc. In search of smart engineers, the traffic inspector of the city has approached you, to create a meaningful insight of the traffic out of the data.

The output from the traffic imaging camera is a second degree differential equation, given as follows-

$$\frac{d^2y}{dt^2} - k_1 \frac{dy}{dt} + k_2 y = 0$$



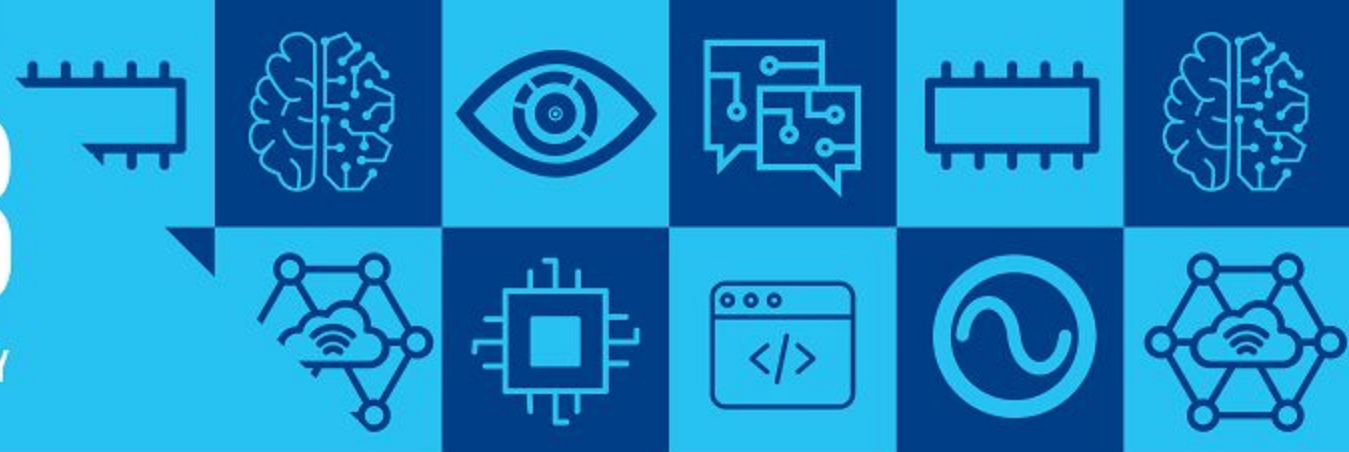
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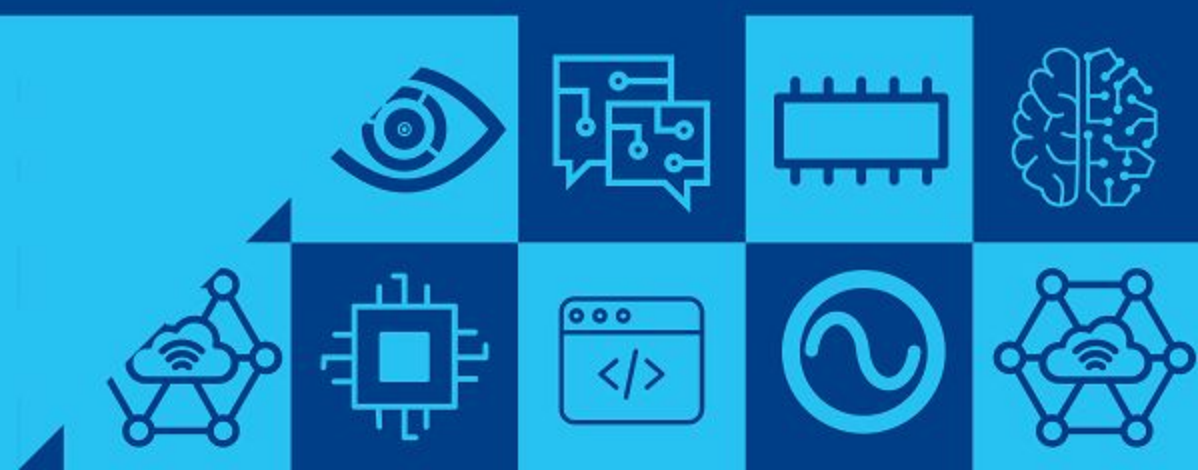
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The parameters k_1 and k_2 in the equation depend on some other miscellaneous factors. They vary with day and time, so described only by their probabilities of occurrence. They have been encoded by Huffman Coding into english letters to avoid the leakage of any confidential information.

Letter	Probability of Occurrence
R	0.20
F	0.15
N	0.15
E	0.10
I	0.10
O	0.10
S	0.10
U	0.05
X	0.03
V	0.02



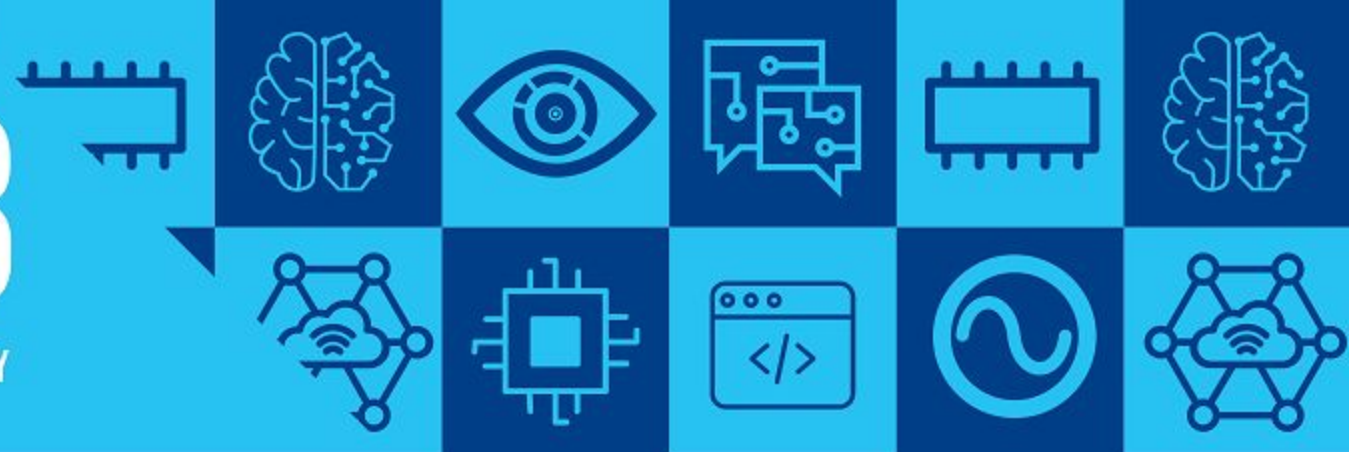
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The huffman codes given to you are as follows-

$$k_1 = 11110101100$$
$$k_2 = 0011010111100$$

Initial Conditions:

At $t=0$,

$$y = 2$$
$$dy/dt = 5$$

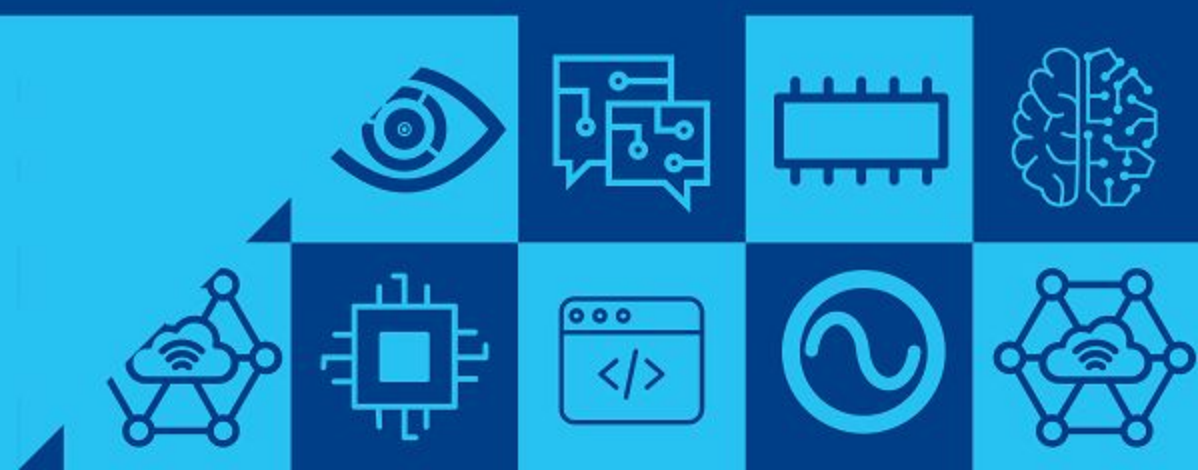
TASK:

You need to decode the coefficients of the differential equation, obtained by solving the Huffman code.

Then, the differential equation obtained has to be solved using electronic hardware components. You have to design the circuit on OrCAD and simulate the output characteristics of the circuit so obtained.



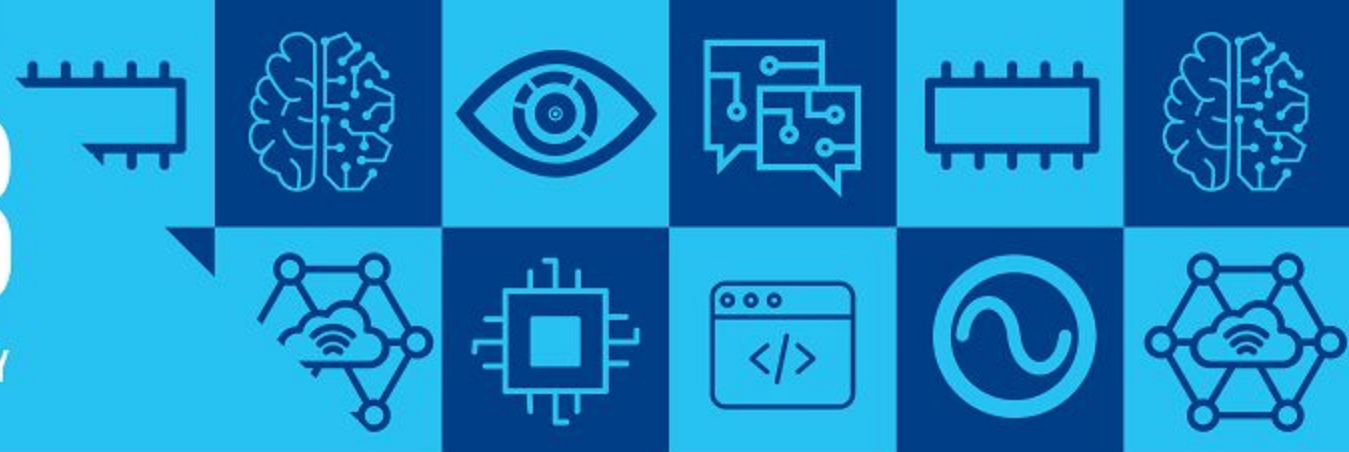
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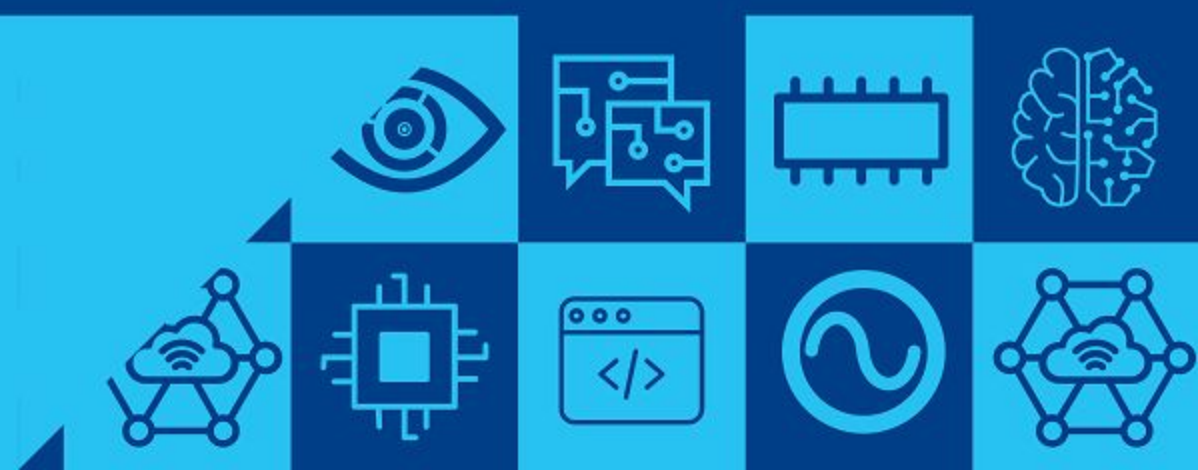
SUBMISSION:

- Create a "New Project" in OrCAD and send the full folder as a zip file. Do not send only the schematic or the simulation files, zip the whole project folder. Upload this zip file to some public folder on a google drive, and submit its link via the google form.
- Submit the screenshot of the circuit made on OrCAD, the simulated waveform of the output(which is the mathematical solution of the differential equation), attached in a document. Make sure the project should be named as your team name, and it should be visible in the title bar of all the screenshots.
- From the graph obtained through simulation, find the value of t for which
$$y(t) = 6$$
- You need to provide an abstract of your solution within 100 words. Solution to huffman coding needs to be done on pen and paper.
- Submit the required answers in a single PDF, named as `<your_team_name>.pdf`

GOOGLE FORM LINK - <https://forms.gle/FWGNfWVNMKCwymK88>



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