# Simulink Modeling

What is Simulink?

It is software tool that enables anyone to model simulate, analyze electrical, mechanical and hydraulic system

Simulink has extensive library.

It is user-firendly tool to analyze, simulate any system to graphical model
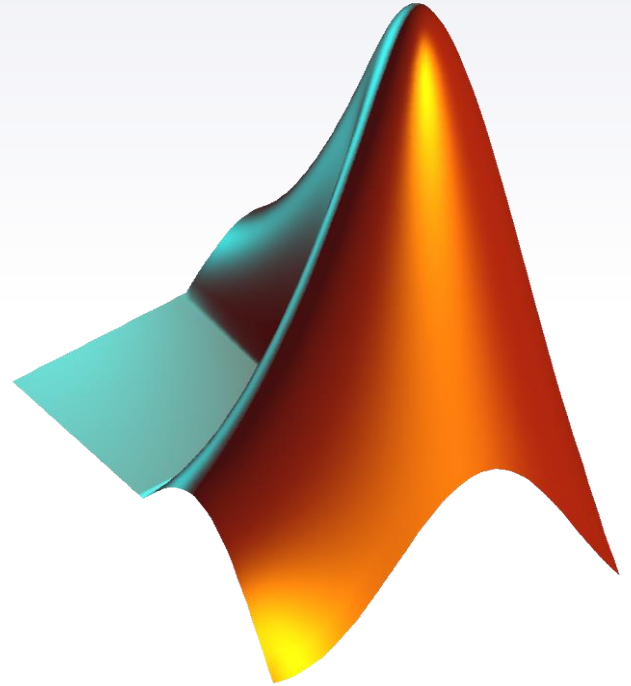
Simulink tutorials for Beginner

In this, we will learn basic understanding of Simulink models and how to create basic Simulink models
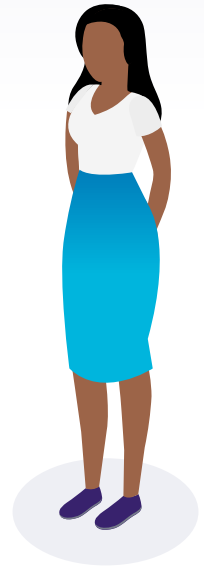
Using MATLAB!

We will be using Simulink library from MATLAB.

Getting Started!

- In the MATLAB command line type "simulink". Simulink's Library Browser will appear.

- From this Simulink window click File New Model to open a new area (file) entitled temporarily untitled. This is where we place the different types of blocks that we click-drag from the library of blocks. Later on don't forget to Save as under a name of your choice.
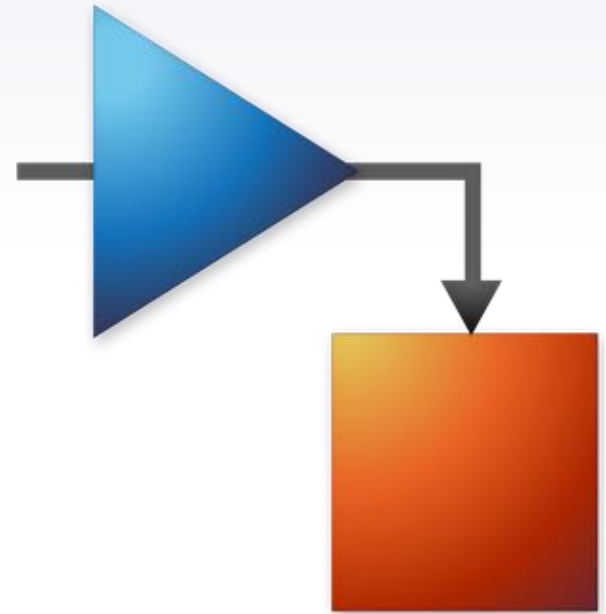
We will study three basic projects using Simulink.

Project 1
Generate, display & export sine wave using and tune its properties

We will learn

- Select block from simulink library

- Add up & view two signals in simulink

- Generate sine wave and tune it's properties.

- Export a variable into the workspace

- Magnify signal using gain parameter

Steps to create sine wave & tune it's parameters

1. Open MATLAB, click on Simulink and open Simulink library. On library page, you can view different Simulink libraries such as Math operations, matrix operation, sinks, sources etc.

2. Click on "Create Simulink model", it will open a perspective to create a Simulink model.

3. Select the 'sine wave' from Sources and simply drag and drop on the model.

4. Select the 'scope' from sink to display the sine wave and connect these two components
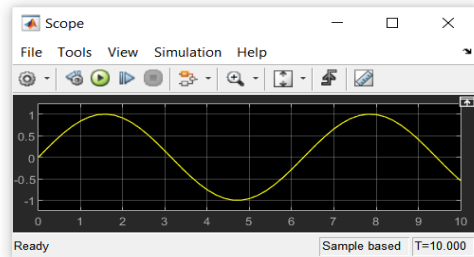
Steps to create sine wave & tune it's parameters (continued...)

1. It will look like this:
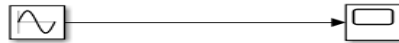
2. We can change the amplitude value of sine wave by double clicking on it.

3. Click on 'run'. To view the output on scope, double click on 'scope':

Change the amplitude value and see the variations

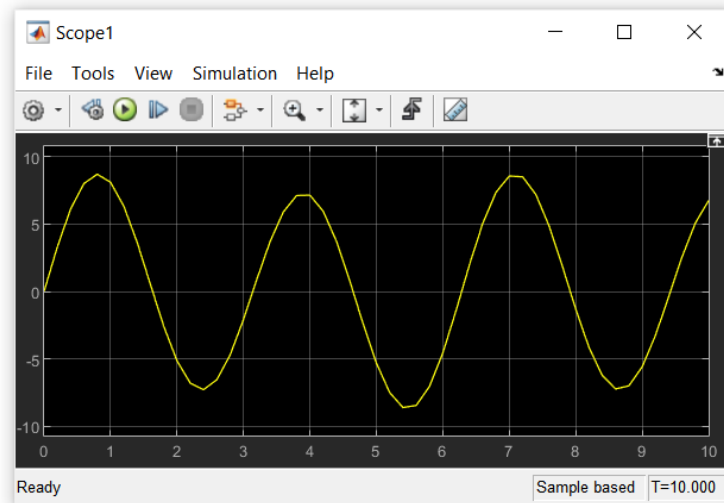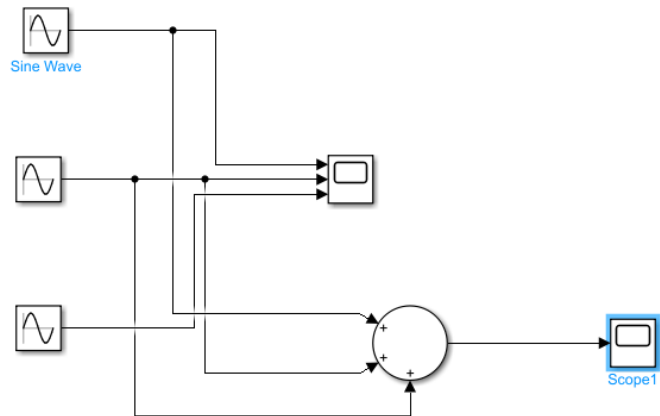# Steps to create sine wave & tune it's parameters (continued…)

1. Now, we will see three sine waves into single scope.

2. Drag and drop three sine waves.

3. Double click on scope and click on setting symbol, on input ports change the value 1 to 3. You will see three ports to scope now.

4. Connect all three sine waves to each input ports.

5. Change the value of frequency or amplitude and see three different sine waves.
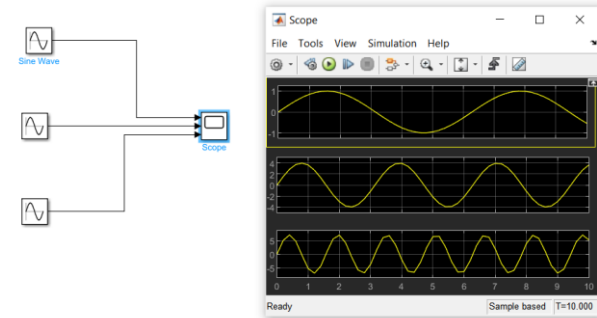
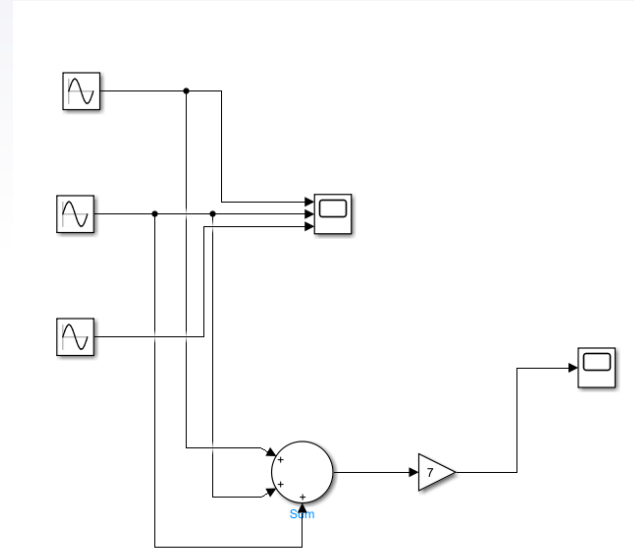# Steps to create sine wave & tune it's parameters (continued...)

1. We will learn now to add three sine wave signal and view it on scope.

2. Select the sum operator from library and drag and drop on the model

3. Now, it has two input ports, we can change it by double clicking on it and add '+' operator in list of signs

4. Give three sine wave signals as input to the sum operator. Add one more signal operator and view the wave now. Output on next slide:

Steps to create sine wave & tune it's parameters (continued…)

1. We will learn to magnify the sine wave signal now using gain operator.

2. Drag and drop gain operator and to input give the input as 'output of a sum operator'.

3. We can change the magnify value by double clicking on gain operator.

4. See the output on scope now.

5. Change the value of gain operator and see the different output waves:
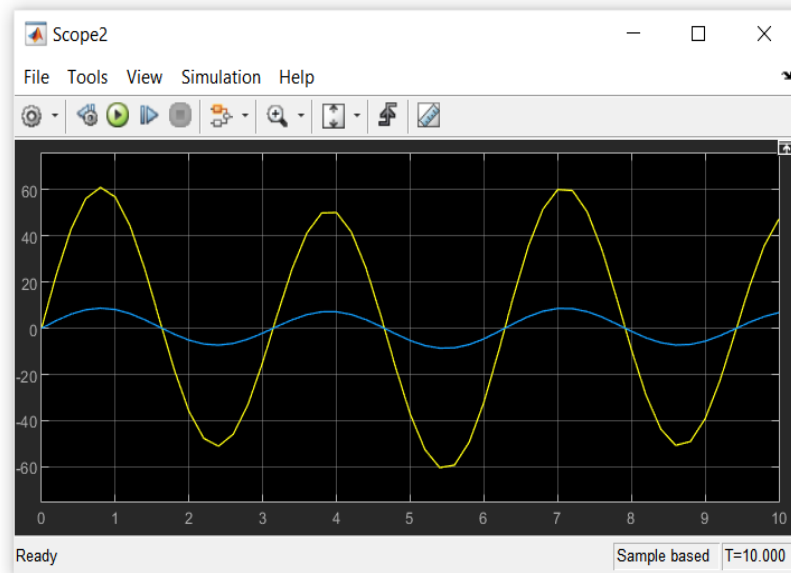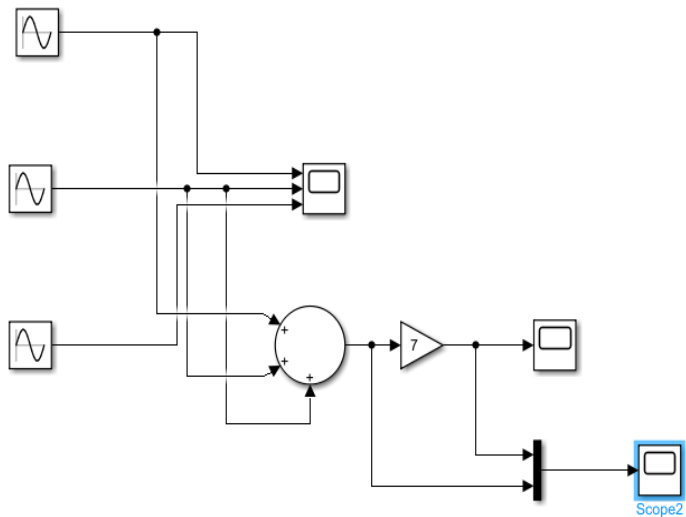
Steps to create sine wave & tune it's parameters (continued...)

1. We will learn the use of mux block. It is used to combine different input into a single output.

2. Drag and drop mux block and give the input as 'output of a sum block' and 'magnify block'

3. Show output on signal block.

4. You will see two waves on single sine wave block.

5. Output on next page.
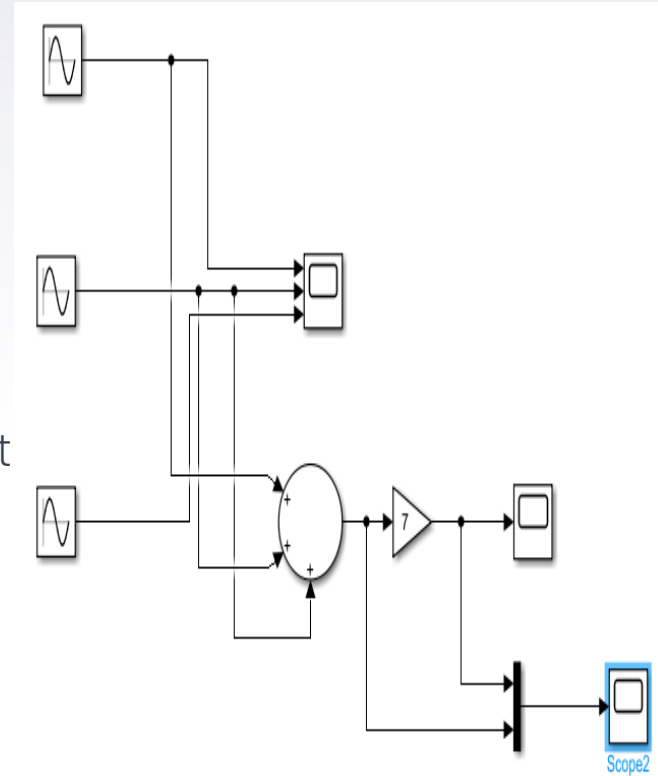
Project 2
Develop mathematical equation using simulink..
The equation converts temp reading from Celsius
into Fahrenheit

We will learn

- Implement mathematical equation in Simulink.

- Call a Simulink model from m-script.

- Feed data from user and use it in model.

Develop mathematical equation using simulink

1. We will create a mathematical equation to convert Celsius to Fahrenheit.

2. The formula is Celsius * (9/5) + 32 = Fahrenheit.

3. We will need two constants, one for Celsius value and one for storing 32 value.

4. We will simply drag and drop these constant block on the model page.

5. We will need one gain block and sum block, We will change the value of gain block to 9/5.

6. We will display out output on display block as shown in fig. 2 Celsius is 35.6 Fahrenheit
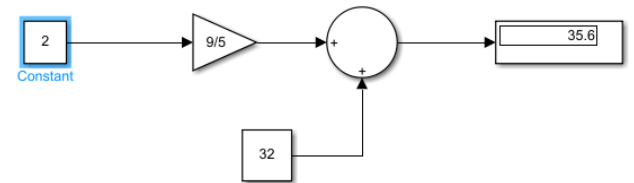
Develop mathematical equation using simulink (Continued...)

1. We will learn to take a value from stored variable for Celsius.
2. On MATLAB command window, put x=5;
3. On Simulink model, we will put Constant value as x.
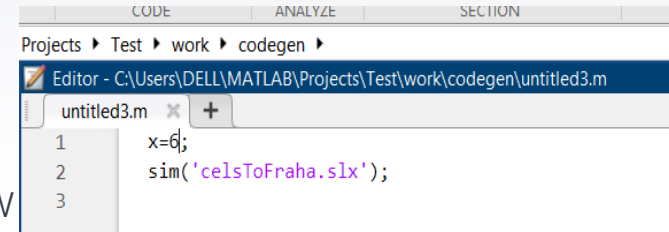4. If we run the model, we will get a output as 41.
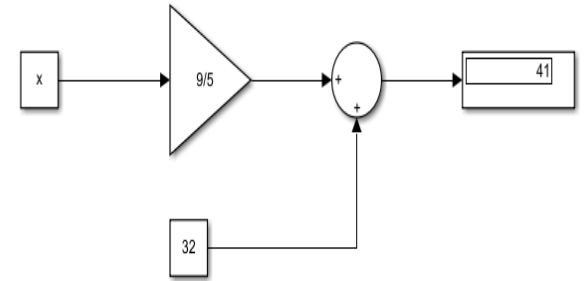
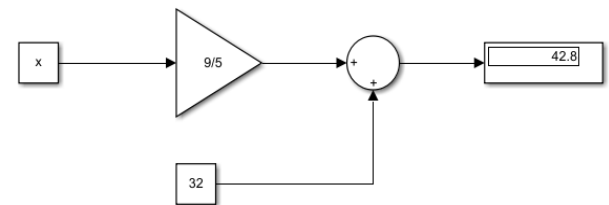# Develop mathematical equation using simulink (Continued...)

1. We will learn to call Simulink model from m_script.
2. On MATLAB, click on create new script and type below script:

   x = 2;

   sim('Simulink_model_filename.slx');

3. Save script file.
4. You can view the output on Simulink Model.

Develop mathematical equation using simulink (Continued...)

```
prompt = 'Please enter a degree celsius : ';
x=input(prompt);
sim('celsToFraha.slx');
```

1. We will learn to feed data to Simulink from user and use it in model.

2. On MATLAB, click on create new script and type below script:

   prompt = 'Please enter a degree celsius : ';

   x=input(prompt);

   sim('celsToFraha.slx');
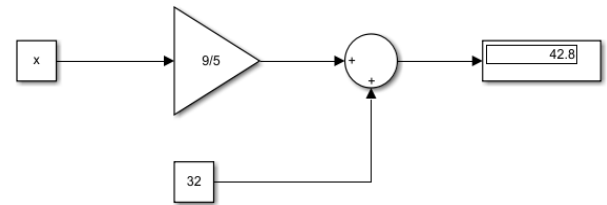
3. Run a script, and provide a value on demand.

4. You can view the output on Simulink Model.

Project 3
Implement logic in Simulink using if else statement

We will learn

- To develop if else logic in Simulink model

- Design selector switch

Develop logic in simulink using if..else statement

1. We will create a sine wave and will give check the condition with respect to x.

2. We will need sine wave, one switch block and two constants one will hold the value 1 and other will hold -1 value.

3. We will simply drag and drop these block on the model page

4. We will connect two constant to two input signal of switch block and will connect sine wave to middle (condition statement) of switch block.

5. We will display output on signal block.

6. If I > 0, it will give 1 as output to signal and if I<0, it will give -1 as output to signal.
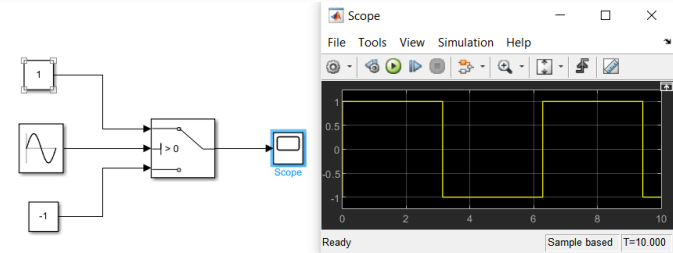
Develop logic in simulink using if..else statement (Continued..)

1. We will see the difference between sine waves using mux operator.

2. See the two different sine waves and use of switch operator.
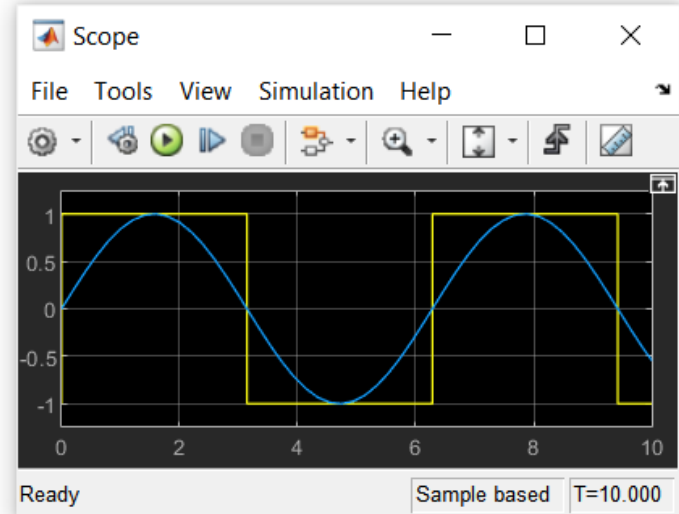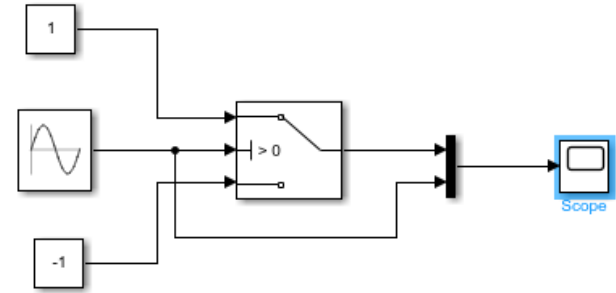
Develop logic in simulink using if..else statement (Continued...)

1. We will learn to develop if..else logic with below condition:

    If(N > 0.5)

    Output = 2*input

    Else if(N < 0)

    Output = 4 * input

    Else output = 10

2. Drag and drop if..else block from Simulink library.

3. Currently, we have two conditions if & else, to add one more else if, double click on if else block, and add comma separated else if conditions. For now we are adding just one else if block.

4. We will also need if action subsystem block, we will need three of these block for our example.

Develop logic in simulink using if..else statement (Continued...)

4. We will show, three actions of three conditions in each action block.
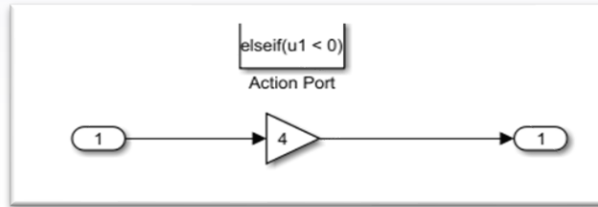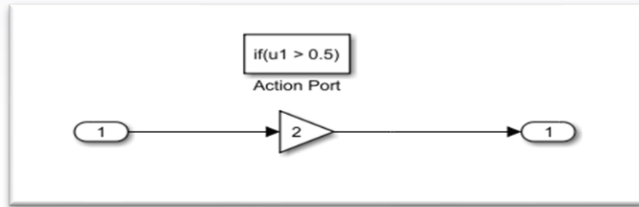
5. We will merge this output into single signal, using merge block.
6. We will display this output on signal block using mux block with original sine wave and new output sine wave
7. Output on next page

Develop logic in simulink using if..else statement (Continued...)
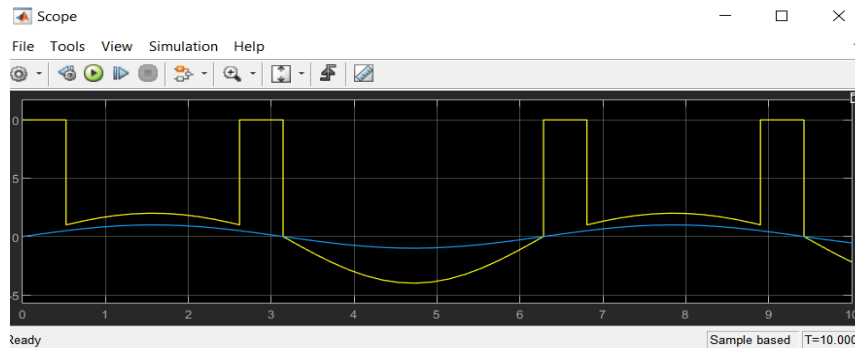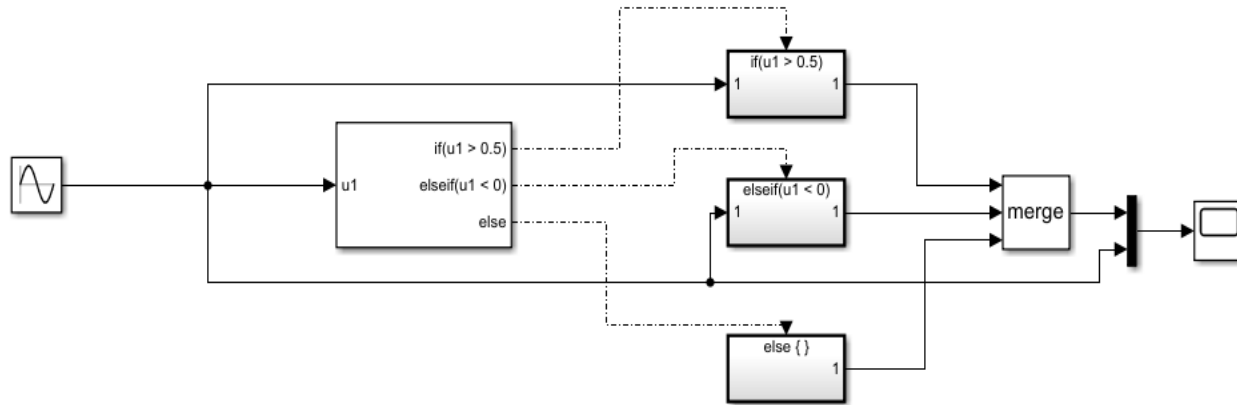
Let's review some concepts

▸ We learned to design basic Simulink model

▸ Use of different blocks in Simulink Library

▸ Export a variable into the workspace

▸ Call Simulink model from m_script

▸ Accept value from user and use in Simulink model.

▸ Develop if..else block

▸ Develop selector switch

▸ Learn if else action subsystem

THANKS!