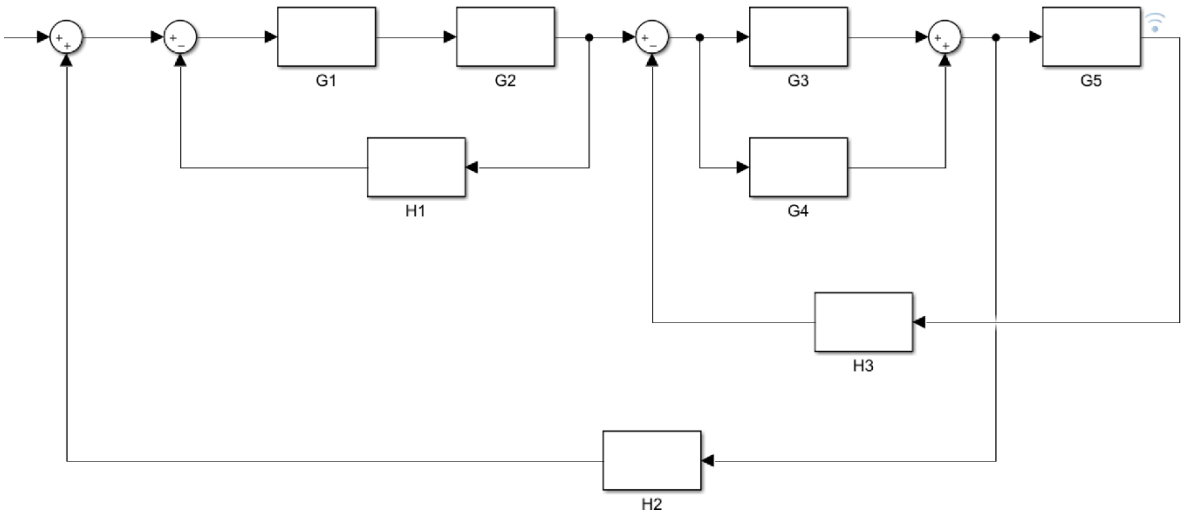


Figure 1

G1: 1/(s+1) H1: 3/(s-5)

G2: 1/(s+2) H2: 1/(s+1)

G3: 1/(s+3) H3: 12/(s+4)

G4: 4

G5: 6

Figure 2

Required installs: Control System Toolbox, Simulink, Optimization Toolbox, System Identification Toolbox, Simulink Control Design.

Figure 1 shows a system of transfer functions, inputting at the top left and outputting after G5 (the Wi-Fi signal). Using MATLAB, obtain the **step response** of the system and print this to a graph.

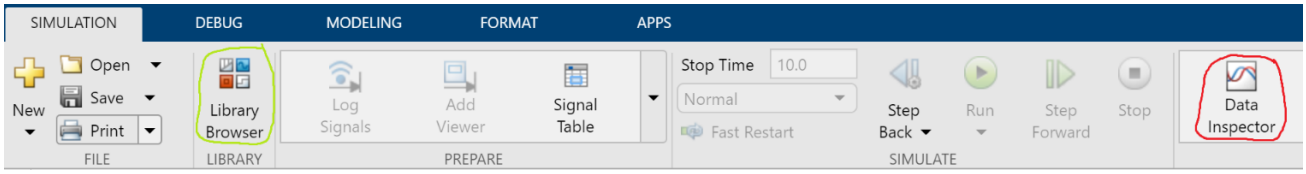
To check your results, there are two options, I would recommend doing both to help develop your knowledge and understanding of the Simulink part of MATLAB.

Option 1: Check the final page of this document.

Option 2: Build the model in Simulink and compare the two graphs to one another.

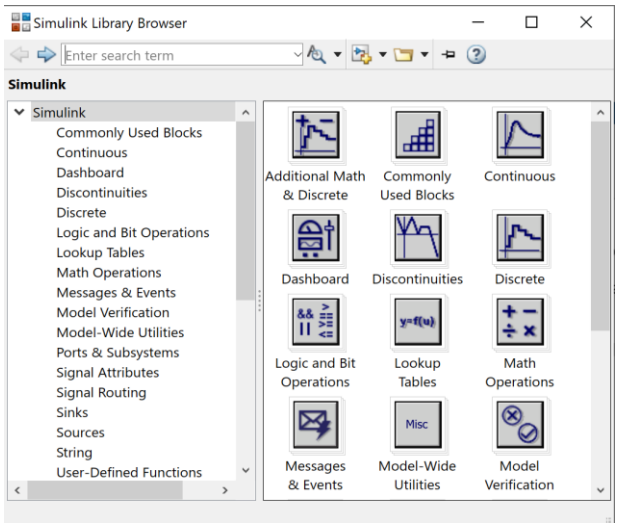
SEE PAGE 2 FOR SIMULINK HELP & DECODE INSTRUCTIONS, PAGE 3 FOR HINTS AND PAGES 4-6 FOR ANSWERS.

To avoid spoiling multiple hints at a time, each hint will be hidden until clicked

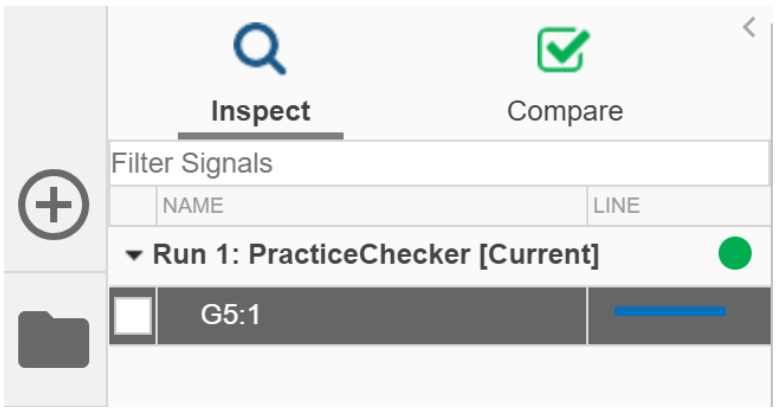


The Toolbar has 2 useful tools for this exercise, the Library Browser contains all the actual blocks, and the Data Inspector is how we will view our output graph.

The Library Browser is easy enough to use, I would recommend searching rather than clicking through the categories.



The Data Inspector requires you to tick the box manually to actually display the graph.



Hint #1, .m file code commands needed: variable.u, variable.y, sumblk, connect, step.

(LAB4, 3)

Hint #2, +/- implementation: Variable = sumblk(output = input1 +/- input2).

(ADDMINUS, 12)

Hint #3, Linking the blocks together: use 'connect' and then inside the brackets list all blocks followed by the first and last "signal".

(LINK, 6)

The next set of hints relates to the use of Simulink to check answers/model the system.

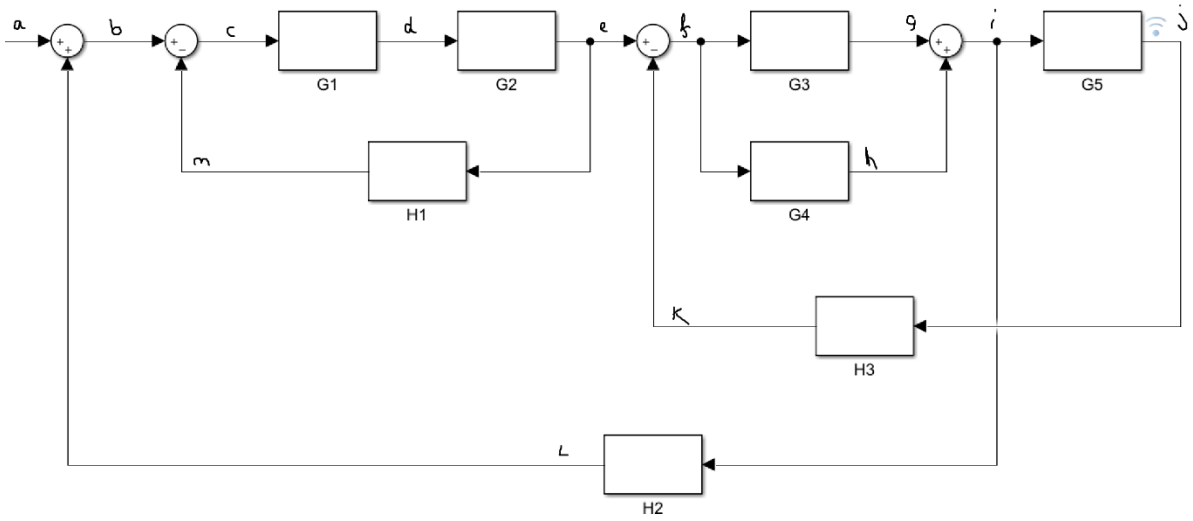
Hint #4, Search terms for blocks: sum, transfer fcn, signal builder.

(MODEL, 19)

Hint #5, Configuring the step: In the signal builder, drag all points to a height of 1.

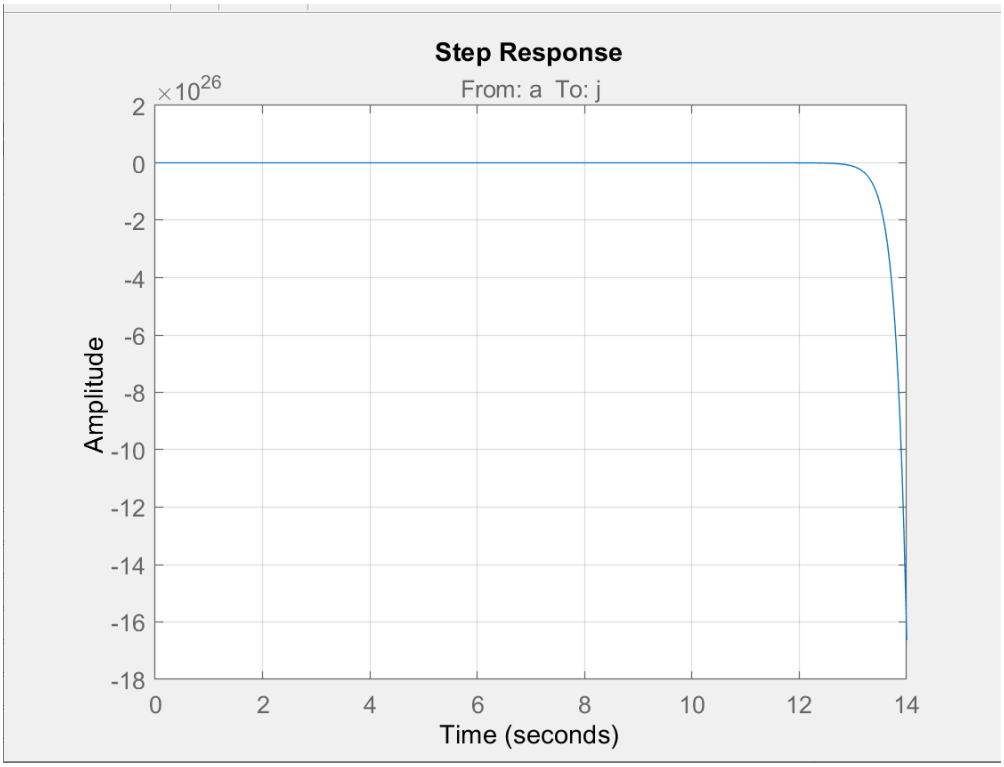
(STEP, 24)

ANSWERS ON THE NEXT PAGE

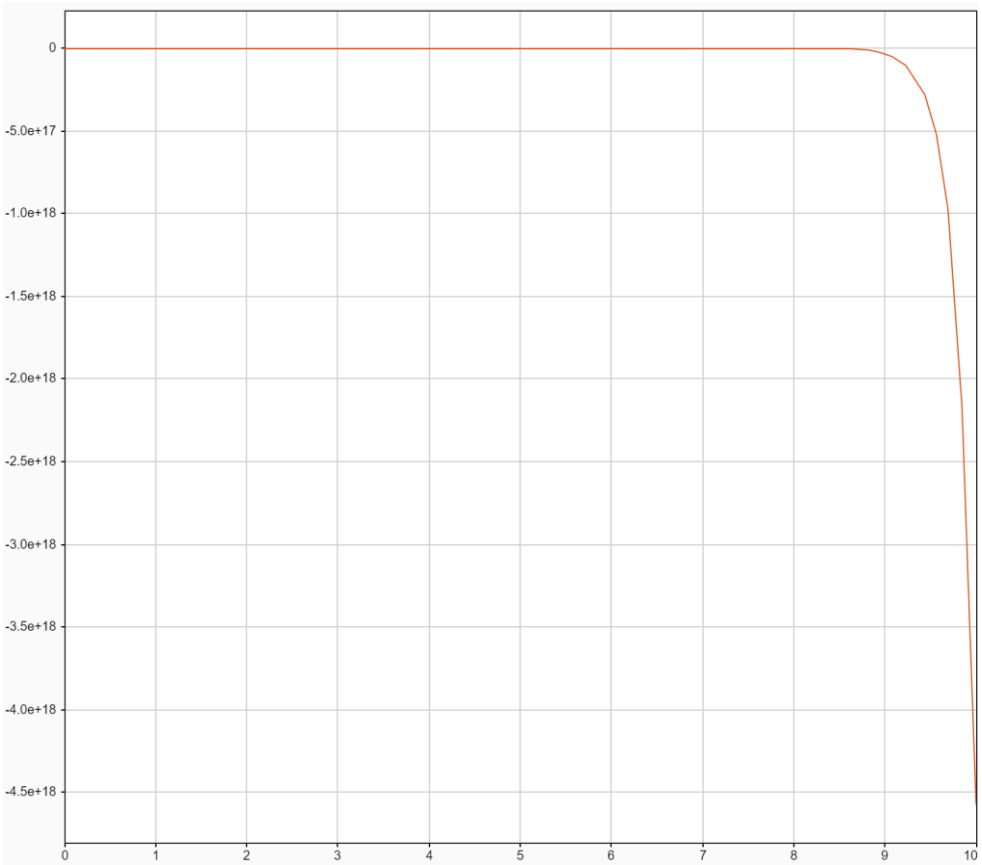


Above is the labelled I/O for the system, variable names are fully interchangeable and as such if you labelled things differently you did not get it wrong. Below is the code using that diagram, producing the correct grid.

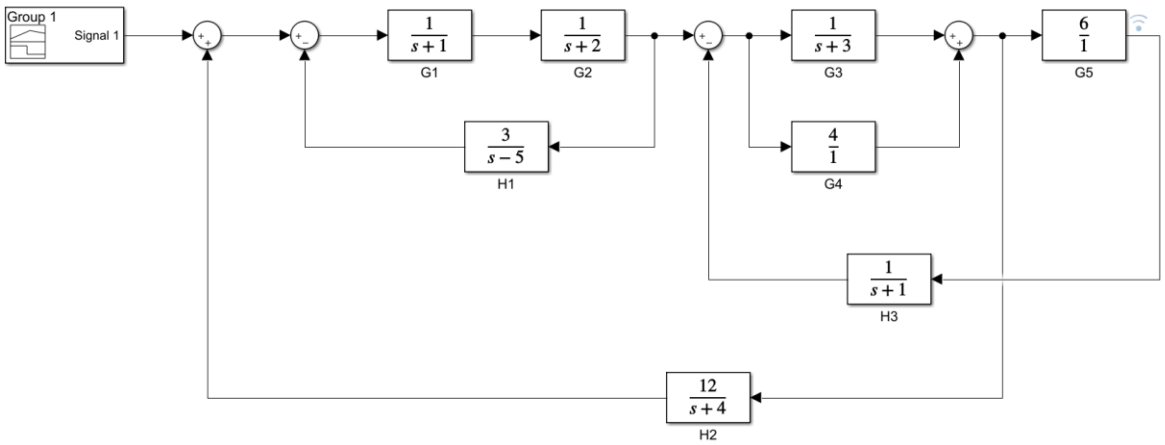
```
s = tf('s');
G1 = 1/(s+1);
G2 = 1/(s+2);
G3 = 1/(s+3);
G4 = 4/(s^0);
G5 = 6/(s^0);
H1 = 3/(s-5);
H2 = 12/(s+4);
H3 = 1/(s+1);
G1.u = 'c';  G1.y = 'd';
G2.u = 'd';  G2.y = 'e';
G3.u = 'f';  G3.y = 'g';
G4.u = 'f';  G4.y = 'h';
G5.u = 'i';  G5.y = 'j';
H1.u = 'e';  H1.y = 'm';
H2.u = 'i';  H2.y = 'l';
H3.u = 'j';  H3.y = 'k';
Sum1 = sumblk('b = a + l');
Sum2 = sumblk('c = b - m');
Sum3 = sumblk('f = e - k');
Sum4 = sumblk('i = g + h');
final = connect(G1,G2,G3,G4,G5,H1,H2,H3,Sum1,Sum2,Sum3,Sum4,'a','j');
step(final), grid
```



The output curve obtained from the code



The output curve from the simulated model



The simulated model.