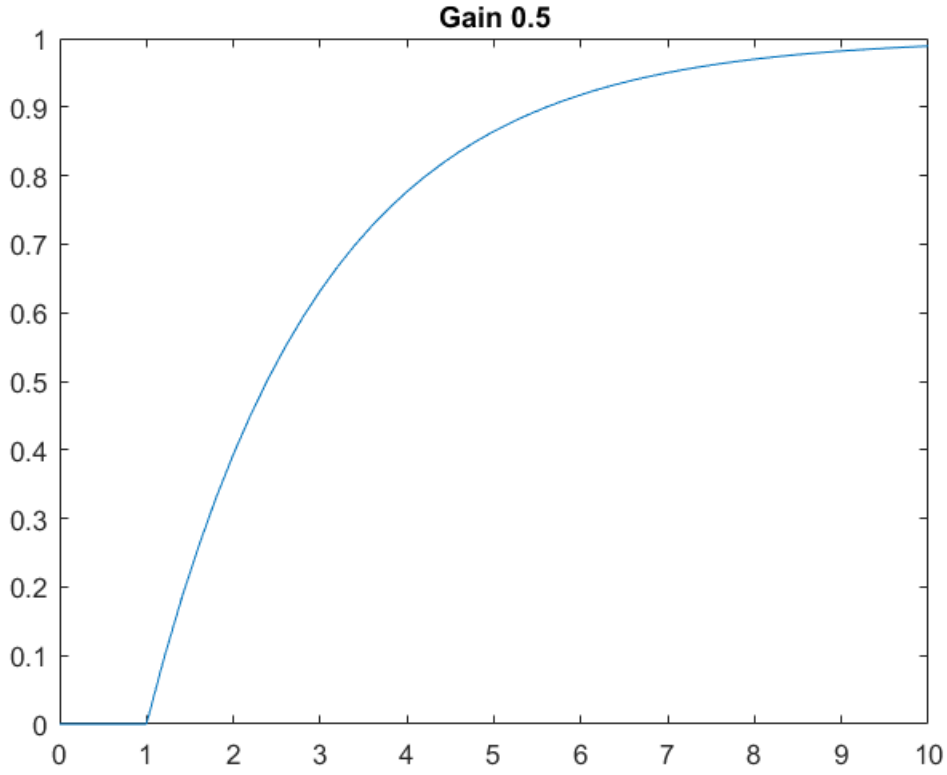
Table of Contents

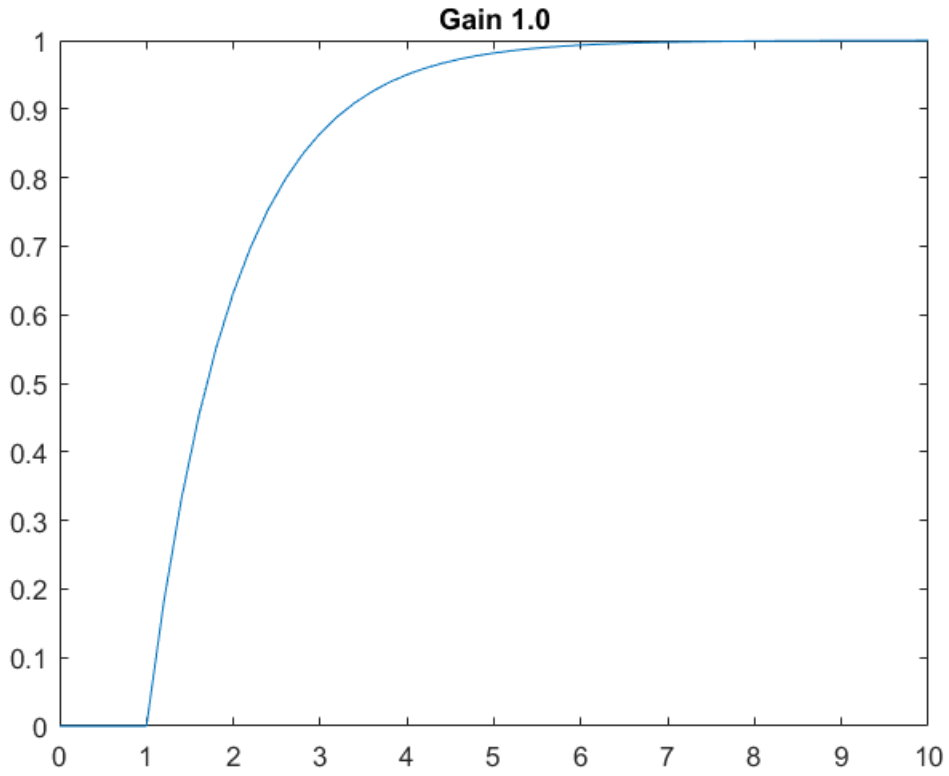
Exercise 1

Stability

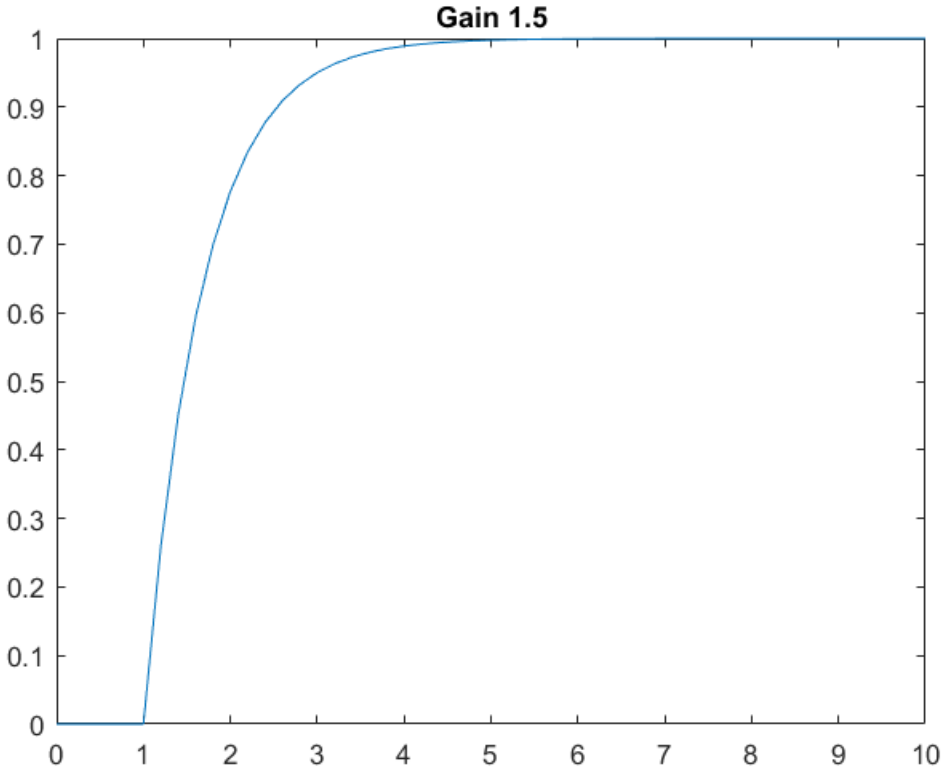
```
Step_Time = 1; %Step Time
Fin_Val = 1;   % Final step value
Den = 1;       % Denumerator

%Gain 0.5
Num = 0.5;     % Numerator
sim('Simulink/Exercise111');
plot(simout.time, simout.signals.values)
title('Gain 0.5')
```



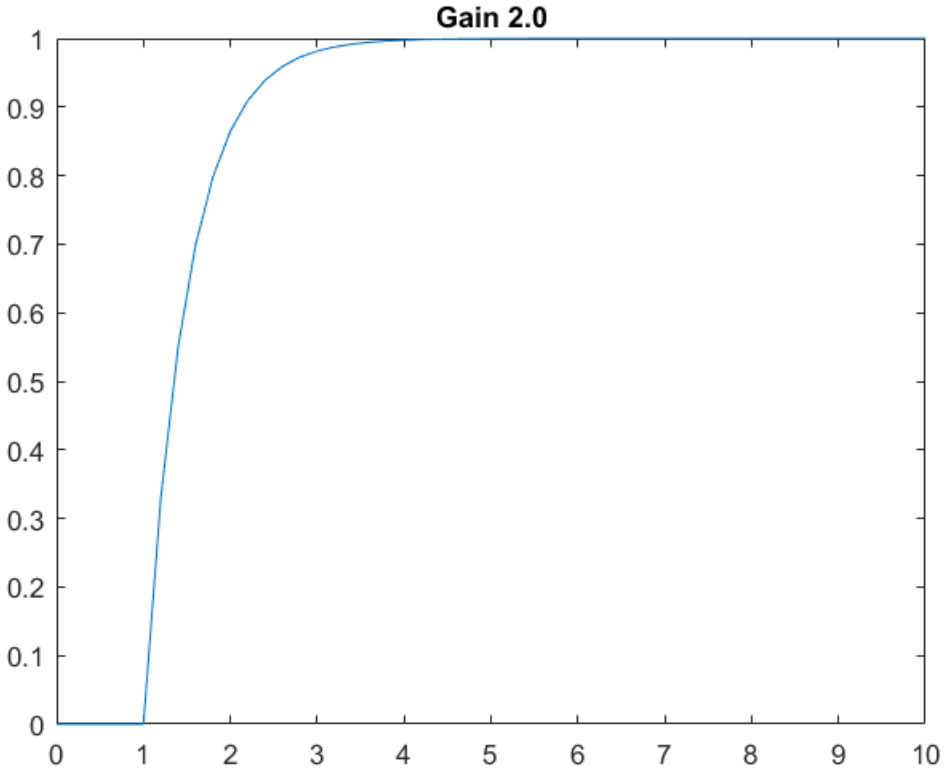
```
%Gain 1
Num = 1;
sim('Simulink/Exercise111');
plot(simout.time, simout.signals.values)
title('Gain 1.0')
```



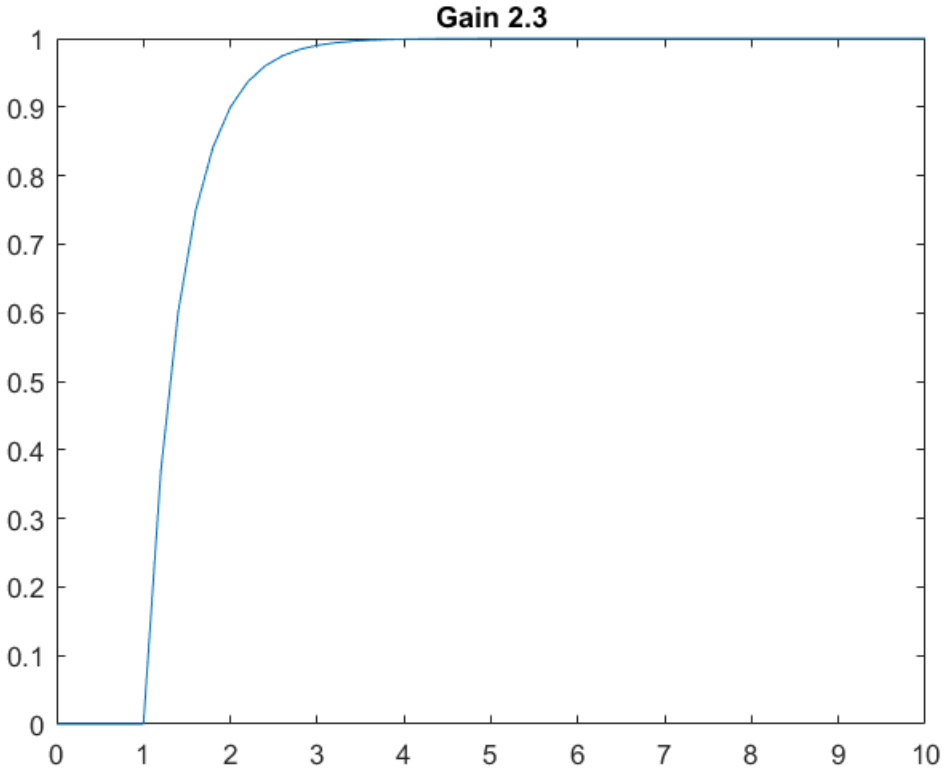

```
%Gain 1.5
Num = 1.5;
sim('Simulink/Exercise111');
plot(simout.time, simout.signals.values)
title('Gain 1.5')
```




```
%Gain 2
Num = 2;
sim('Simulink/Exercise111');
plot(simout.time, simout.signals.values)
title('Gain 2.0')
Max2 = max(simout.signals.values);
```




```
%Gain 2.3
Num = 2.3;
sim('Simulink/Exercise111');
plot(simout.time, simout.signals.values)
title('Gain 2.3')
```



Exercise 1.1.1 and 1.1.2

What is the maximum output for gain 2.0? What is the gain limit for a stable continuous system?

```
fprintf('max output = %.3f ',Max2);
display('The maximum gain is infinite');
```

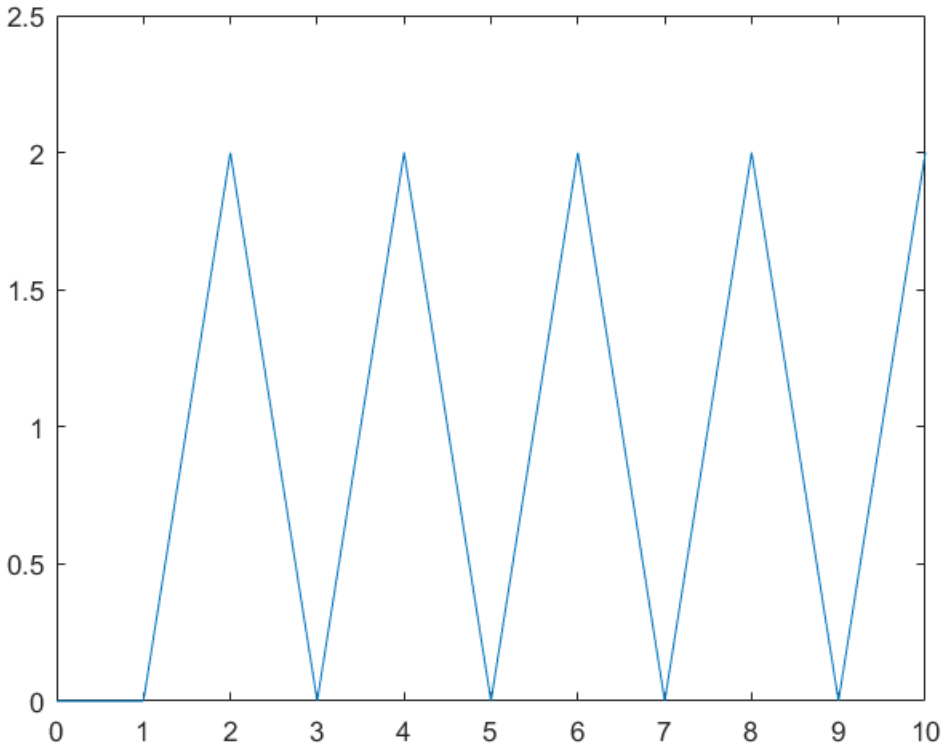
```
max output = 1.000 The maximum gain is infinite
```

Exercise 1.1.3 and 1.1.4

What is the maximum output for gain 2.0? What is the gain limit for a stable sampled system?

```
Num = 2;
sim('Simulink/Exercise112');
plot(simout.time, simout.signals.values)
Max2 = max(simout.signals.values);
fprintf('max output = %.3f ',Max2);
display('The maximum gain is 2(marginally stable)');
```

```
max output = 2.000 The maximum gain is 2(marginally stable)
```



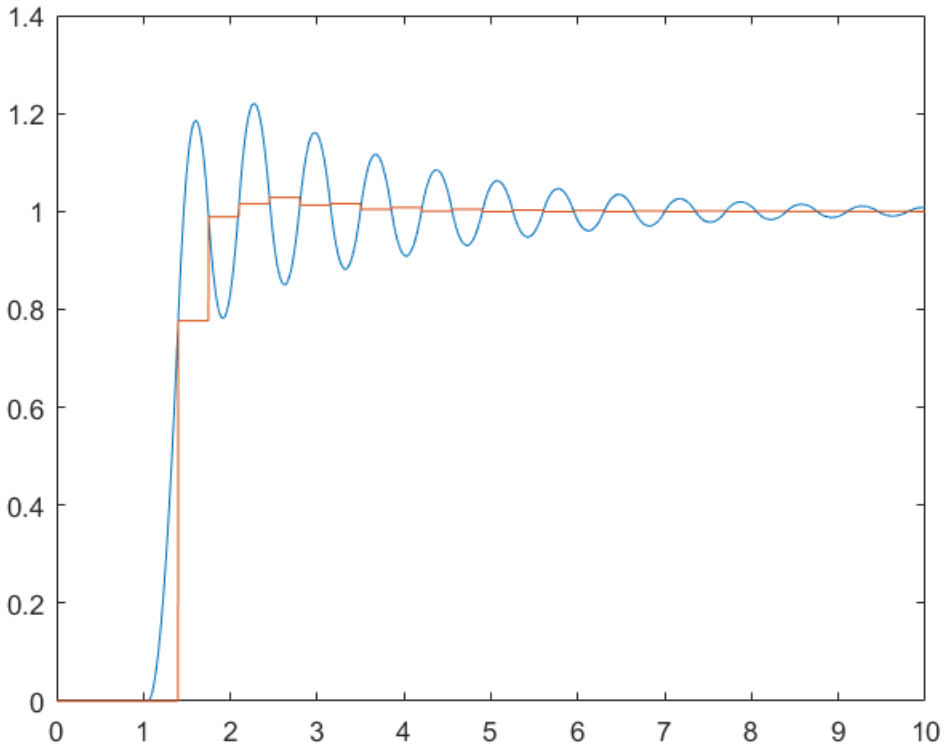
Exercise 1.2

Exercise 1.2.1/2

What is the maximum output for the continous and discrete system, sampletime 0.35?

```
Ts = 0.35;
sim('Simulink/Exercise121');
plot(simout.time, simout.signals.values);
Max = max(simout.signals.values);
fprintf('Ts = %.2f',Ts);
fprintf('max cont: %.3f, max disc: %.3f',Max(1), Max(2));
```

```
Ts = 0.35max cont: 1.220, max disc: 1.028
```

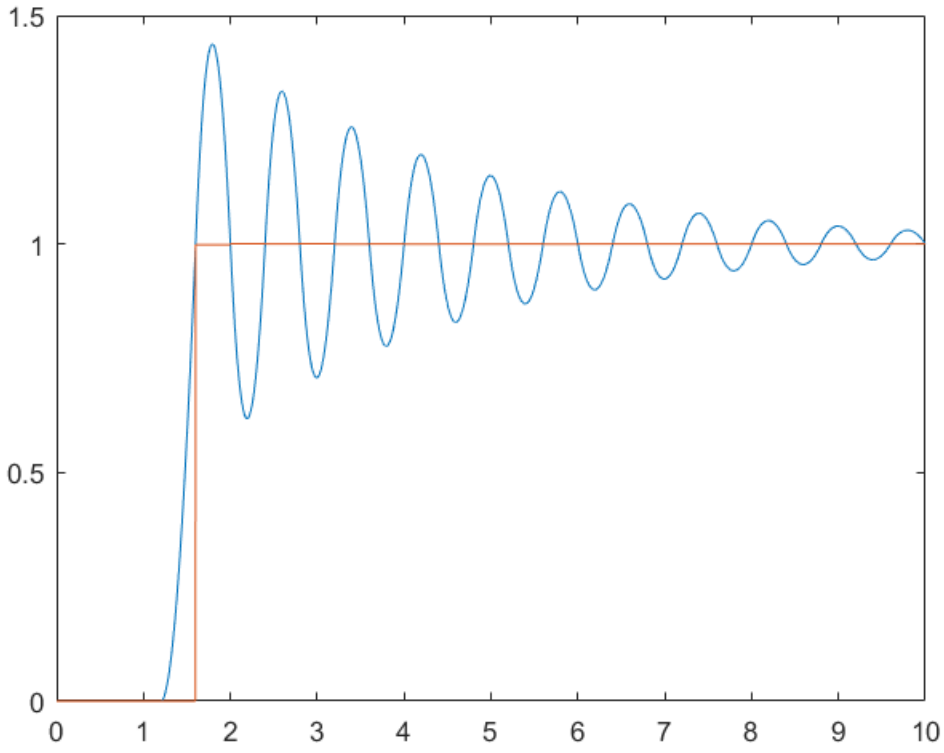


Exercise 1.2.3/4

What is the maximum output for the continous and discrete system, sampletime 0.4?

```
Ts = 0.4;
sim('Simulink/Exercise121');
plot(simout.time, simout.signals.values);
Max = max(simout.signals.values);
fprintf('Ts = %.2f',Ts);
fprintf('max cont: %.3f, max disc: %.3f',Max(1), Max(2));
```

```
Ts = 0.40max cont: 1.437, max disc: 1.001
```

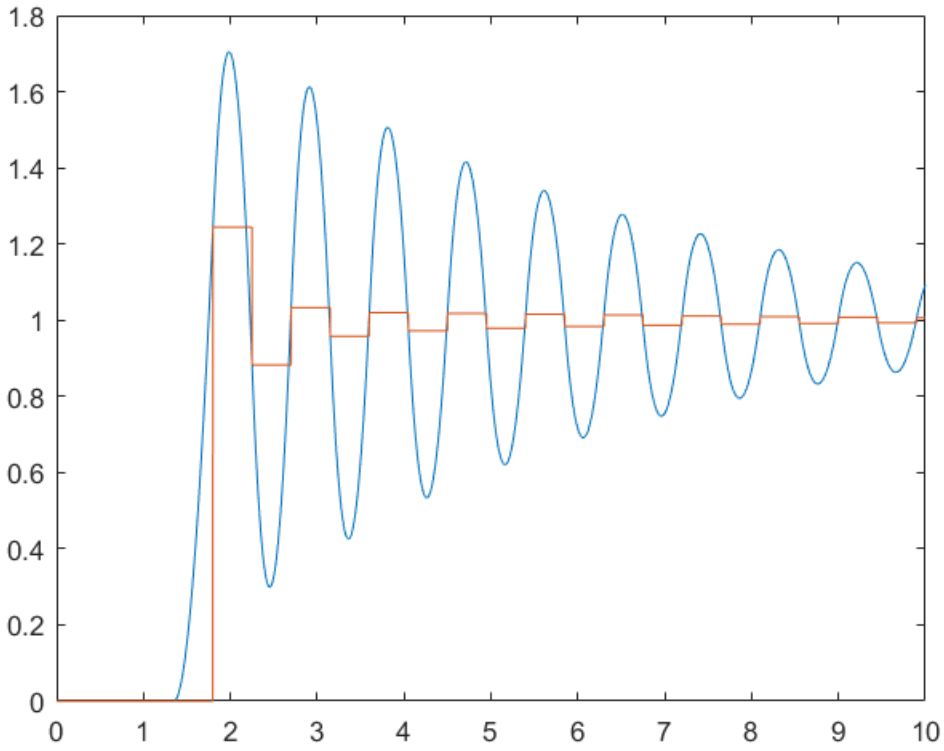


Exercise 1.2.5/6

What is the maximum output for the continous and discrete system, sampletime 0.45?

```
Ts = 0.45;
sim('Simulink/Exercise121');
plot(simout.time, simout.signals.values);
Max = max(simout.signals.values);
fprintf('Ts = %.2f',Ts);
fprintf('max cont: %.3f, max disc: %.3f',Max(1), Max(2));
```

```
Ts = 0.45max cont: 1.704, max disc: 1.244
```



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