1. The transfer function below has a numerator term which goes to zero at $z = -1$. What frequency does this correspond to if $f_s = 1000$ Hz.

$$H(z) = \frac{z + 1}{z^2 - 3z + 1}$$

2. If the step response of a DSP system is given by $h(nT) = \{.25, .5, .75, 1, 1, 1, 1, \ldots\}$, what is the impulse response of the system?

3. What is the transfer function in $z$ of each of the following systems?

A)

```
    T      T
    u    Y
```

B)

```
    +      T      T
    u    Y
```

C)

```
    +      T      T
    u    Y
```

4. What causes aliasing?
5. Write the equation for a sinusoid and its \textit{first} alias if $f_s = 1000\text{Hz}$. Take the sine frequency to be $250\text{Hz}$.

6. Two systems have the same impulse response. If the systems are know to be linear, are the two systems identical? Explain why or why not. In your answer address the following questions:
A) Are the components the same?
B) Are the transfer functions the same?
C) Are the step responses the same?

7. Write the expression for the magnitude of the frequency response at $200\text{Hz}$ for a system whose impulse response is given by $h(nT) = \{0.5, 1.0, 0.5, 0, 0, \cdots\}$. Take $f_s$ to be $1000\text{Hz}$. Show your work.
8. Answer the questions below for the system shown.

A) Find the transfer function in z.

B) Write the difference equation for the system.

C) Assign state variables and write the state variable equations for the system.