1. As shown on the right, six parameters of an ideal operational amplifier are listed. Circle the correct value for each parameter.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential gain</td>
<td>0</td>
</tr>
<tr>
<td>Common mode gain</td>
<td>0</td>
</tr>
<tr>
<td>Common mode rejection ratio</td>
<td>0</td>
</tr>
<tr>
<td>Input impedance</td>
<td>0</td>
</tr>
<tr>
<td>Output impedance</td>
<td>0</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>0</td>
</tr>
</tbody>
</table>

2. ( ) Refer to the circuit on the right for questions 2 to 5. The stage-1 gain is defined by \((V_3 - V_4) / (V_1 - V_2)\). If we want to set the first-stage gain to 5.7, what value should be chosen for \(R_1\)? (A) 100 KΩ, (B) 200 KΩ, (C) 330 KΩ, (D) 470 KΩ, (E) none of the above.

3. ( ) The stage-2 gain is defined by \(V_5 / (V_3 - V_4)\). What is the gain for stage 2? (A) –4.7, (B) –5.7, (C) –9.4, (D) –11.4, (E) none of the above.

4. ( ) Stage 3 is a bandpass filter with a passing band between 1 Hz and 30 Hz. If we choose \(C_5 = 2 \, \text{μF}\), what value should \(R_5\) be set at? (A) 24 KΩ, (B) 33 KΩ, (C) 56 KΩ, (D) 80 KΩ, (E) none of the above.

5. ( ) For stage 3, if choose \(C_6 = 0.22 \, \text{μF}\), what value should \(R_6\) be set at? (A) 24 KΩ, (B) 33 KΩ, (C) 56 KΩ, (D) 80 KΩ, (E) none of the above.

6. ( ) The C code on the right implements a digital filter. The input comes from ReadADC() subroutine, which acquires data from the on-chip A/D. The output is sent to port D, which is connected to an external D/A. What kind of filter is this? (A) FIR and causal, (B) FIR and noncausal, (C) IIR and causal, (D) IIR and noncausal, (E) none of the above.

```c
uns8 input0, input1;
uns8 output0, output1;
uns16 temp;
...
input1 = input0;
input0 = ReadADC();
temp = input0;
temp += input0;
temp += input1;
temp += output1;
temp = temp >> 2;
output0 = temp;
PORTD = output0;
```

7. ( ) For the above problem, what is the filter equation? (A) \(y[n] = (y[n-1] + x[n] + x[n-1]) / 2\), (B) \(y[n] = (y[n-1] + 2x[n] + x[n-1]) / 4\), (C) \(y[n] = (y[n] + 2x[n] + x[n-1]) / 2\), (D) \(y[n] = (y[n] + x[n] + x[n-1]) / 4\), (E) none of the above.
8. We implement a digital filter according to: \( y[n] = x[n] - x[n-2] + y[n-2]/4 \), where \( y[n] \) is the present output and \( x[n] \) the present input. Which of the following is the correct transfer function \( H(z) \) for this filter? (A) \( (z-1)^2/(z-1/4)^2 \), (B) \( (z^2-1)/(z^2-1/4) \), (C) \( (z+1)^2/(z+1/4)^2 \), (D) \( (z^2+1)/(z^2+1/4) \), (E) none of the above.

9. For the above problem, which of the following is the correct pole-zero plot for this filter?

10. For the above problem, we choose a sampling rate of 500 Hz. Which of the following is the correct frequency response, i.e. magnitude of \( H(e^{j2\pi f}) \), for this filter?

(E) none of the above.