

NAME: \_\_\_\_\_

GRADE: \_\_\_\_\_

EE442 / EE592 Real-Time Digital Signal Processing  
Quiz #2

Allowed: Textbook, Notes, and Calculator

*Each question is worth 10 points unless otherwise noted.*

1. Consider a digital filter whose impulse response is given by

$$h[n] = \delta[n] + \frac{1}{2}\delta[n-3] + \frac{1}{4}\delta[n-6].$$

For the input signal

$$x[n] = \delta[n] + \delta[n-1] + \delta[n-2] + \delta[n-3].$$

Determine the output signal for  $0 \leq n \leq 10$ .

2. Suppose we have two values in registers x0 and x1. Write a code which will perform the following steps:

```
if x0 >= x1
    x0 = x0 / 2
else
    x1 = x1 / 2
end
```

Write a code for the following real-time programming tasks (Questions 3 – 5, 7), using the Modified Pass Pack (Appendix B in textbook) as a base code. Identify by file name (**pass.asm**, **pass.dat**, **proginit.asm**, and **procster.asm**) and line number where you would place your instructions. The first programming task is done as an example.

3. Write a code which multiplies the right channel by  $g = 0.7$ .

*Solution:*

In **pass.dat** insert after line 10 the following line:

```
g    equ    0.7
```

In **procster.asm** replace the NOP the following line:

```
    mpyr    #g,x0,a    ;multiply right sample by g and round
```

In **pass.asm** replace line 74 with the following line:

```
    move    a,x:TX_BUFF_BASE    ;transmit right sample
```

4. Write a code which will create and zero out a circular queue (delay line) of length 8,000 samples. Also equate the label DELTA with the value 4000.

5. Using your code in Question 4, write additional code which computes

$$y[n] = x[n] + 0.67x[n - 4000] + 0.33x[n - 8000]$$

for *right-channel* input samples (your output should be sent to the right channel of the D/A). You must use the index by offset addressing mode and DELTA should be loaded into the offset register.

***Nxt two pages EE592 only***

EE442 students: if time permits, you may wish to try these problems, however, no additional points will be earned.

6. Consider the following difference equation representation of a digital filter

$$y[n] = 0.33y[n-2] + 0.67x[n].$$

(a) Draw a Direct Form (DF) I realization of the difference equation.

(b) Draw a DF II (canonical realization) of the difference equation.

(c) Write the state equations for the DF II realization.

7. Using the Modified Pass Pack and your answer in Question 6, write a code (using same format as in Questions 3 - 5) which filters the *right* channel.