

EE442 / EE592 Real-Time Digital Signal Processing
Quiz #4
Allowed: Books, Code Printouts, Calculator, and Notes

Each question is worth 10 points unless otherwise noted.

1. What Texas Instruments processor and development board are we using?

2. In the DSPFixedPointFunctions, we frequently use `cdelay()`. Please explain why we use `cdelay`.

Explain (with details), why we call `cdelay()` as

`cdelay(short D, short *w, short **p)`

instead of

`cdelay(short D, short *w, short *p)`

3. Fill in the table

<i>Parity Type</i>	<i>Data</i>	<i>Parity Bit</i>
	1010101	1
Odd	0101010	
	1100110	0
Odd	0011001	
	1010101	0
Even	0101010	
	1100110	1
Even	0011001	

4. Provide the value, z for the following code

```
short x, y, z;

void main (void)
{
    x = -16000;
    y = 17000;
    z = x - y;
}

z = ?
```

5. Provide the value, z for the following code

```
short x, y
int z;

void main (void)
{
    x = 8192;
    y = 16384;
    z = (x * y)>>15;
}

z = ?
```

6. Write a code (similar to that in Problem 5) that will compute the following for a fixed-point processor:

$$z = [1 \quad 2 \quad 3] \begin{bmatrix} 4 \\ 5 \\ 6 \end{bmatrix}$$

Your result z should be rounded and returned as a short. Finally, you may use functions in DSPFixedPointFunctions.

7. In all of the DSP routines involving a circular array to store filter states, the array `w` and the oldest filter state `p` are passed as input arguments. For example

```
short cfir(short M, short *h, short *w, short **p, short x)
```

is called in `process_signal()` with

```
*outputRight = cfir(FILTERORDER, coeffs, states, &oldestStatePtr, inputRight);
```

Please explain why

```
short cfir(short M, short *h, short *w, short *p, short x)
```

and

```
*outputRight = cfir(FILTERORDER, coeffs, states, *oldestStatePtr, inputRight);
```

will not properly implement a circular array.

8. Write a function `comb()` which implements the comb filter from *Project #1*. The state equations are given on p. 170:

$$\begin{aligned}w_0[n] &= x[n] + gw_m[n] \\y[n] &= w_m[n] \\w_k[n+1] &= w_{k-1}[n], \quad k = m, m-1, \dots, 1\end{aligned}$$

Solution:

EE592 Only

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

9. Consider the `lookup_wavIntDelta.c` and `lookup_wav.c` functions for wavetable synthesis. Assume 256 samples of a sinusoid (tone) are stored in a table and $f_s = 16,000$ samples/s.

(a) For synthesis of a 1125 Hz tone, determine the value `delta` (short) that will be used as input to `lookup_wavIntDelta`.

(b) For synthesis of a 440 Hz tone, determine the value `delta` (int) that will be used as input to `lookup_wavIntDelta`.