

ARIZONA STATE UNIVERSITY  
DEPARTMENT OF ELECTRICAL ENGINEERING  
**EEE 498/591 Spring 2009**  
**Problem Set #2**

Assigned: 20 February 2009

Due Date: 4 March 2009

Reading: Read Sections 3.1 to 3.6 in Kuo & Gan. Read Chapters 2, 3, and 4 of the *DSP56800E 16-bit DSP Core Reference Manual*. Read Sections 1.11 and 1.12 of Chapter 1 of the *DSP5685x Digital Signal Processor User's Manual*.

Announcement: Exam 1 will be held on Wednesday 18 March 2009 during class time. Online students should arrange with their proctors to take Exam 1 on Wednesday 18 March 2009. The Exam will cover the class lecture material, reading, and problems assigned in homeworks 1 and 2. Exam 1 will be *closed book* and *closed notes*. Only one  $8\frac{1}{2} \times 11$  page of *hand-written* notes is allowed. No calculators and no other devices are allowed, except for a pencil, pen, eraser, and ruler.

**PROBLEM 2.1:**

Consider a DSP56858 with the following hexadecimal values stored in accumulator A, address registers R0, R1, and N, data register X0, and data memory X at locations \$001117 to \$00111E.

A: 

0	F	F	9	A	4	2	7	C
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R0: 

0	0	1	1	1	8
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R1: 

0	0	2	2	3	7
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N: 

0	0	0	0	0	3
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X0: 

7	C	2	5
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X:	\$00111E	9	8	8	7
	\$00111D	A	3	B	6
	\$00111C	7	2	A	0
	\$00111B	B	3	A	5
	\$00111A	8	B	6	1
	\$001119	5	0	0	0
	\$001118	8	9	1	F
	\$001117	F	7	3	2

For each of the following instructions, determine which register(s) and/or data locations have been modified and their updated values.

*Note: for each instruction, start with the initial values given above.*

- (a) MOVE.BP X: (R1), Y1

Modified Locations/Registers	Current Updated Value

(b) MOVE.W X: (R0+2), A

Modified Locations/Registers	Current Updated Value

(c) MOVE.W X: (R0)+N, A

Modified Locations/Registers	Current Updated Value

(d) MOVE.L X: (R0)-, A

Modified Locations/Registers	Current Updated Value

**PROBLEM 2.2:**

Problem B-2-22, page 89 in Kuo & Gan.

**PROBLEM 2.3:**

Problem B-3-11 in Kuo & Gan.

**PROBLEM 2.4:**

The speech signal  $s(t)$  is sampled with a sampling rate  $f_s = 8KHz$  (Hz) producing the sequence  $s(n)$ .

- (a) Let  $X(K)$  be the  $N$ -point DFT of the sampled speech signal  $s(n)$ . Determine the size of the DFT,  $N$ , so that the effective spacing between DFT frequencies (i.e., the DFT frequency resolution) is 40 Hz.
- (b) Compute and plot the 4-point DFT of the following 4-point sequence:

$$s(n) = \begin{cases} 2, & n = 0 \\ 1, & n = 1 \\ 1, & n = 3 \\ 0, & \text{otherwise} \end{cases}$$

**PROBLEM 2.5:**

- (a) Find the binary two's complement representation of the decimal number 2.375.
- (b) Find the 2's complement Q2.2 representation of the decimal number 2.375, and determine the resulting quantization error.
- (c) (1.5 points) Determine the decimal value of the Q4.1 2's complement number 100110.
- (d) Compute the product  $p = x \times y$ , where the multiplicand  $x = 0101$  and the multiplier  $y = 1101$  in 2's complement representation.