**COSC2406**

**Assembly Language Programming**

**Assignment 1**

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**SHOW ALL YOUR WORK (either in the same document or as a separate PDF scan), NO SUPPORT = 50% PENALTY. All your calculation work must be provided with the assignment.Submit your completed assignment electronically via Brightspace.**

1. [10] Using Number Set#1 – (Decimal 39, 78, 221, 145) for this assignment and presuming an 8-bit number system (meaning that all numbers are 8-bits in size), convert each of the following numbers into:

a. Hexadecimal representation

1. 39

To convert to hexadecimal, you can use the remainder method. Divide 39 by 16:

Divide 39/16 = Q:2, R:7 (Q: Quotient, R: Reminder)

Divide 2/16 = Q:0, R:7

The final quotient is 0 and reminders are 7 and 2

The hexadecimal representation is 27.

2. 78

To convert to hexadecimal, you can use the remainder method. Divide 78 by 16:

Divide 78/16 = Q:4, R:E(14 in decimal)

Divide 4/16 = Q:0, R:4

The final quotient is 0 and the remainders are E and 4.

The hexadecimal representation is 4E.

3. 221

To convert to hexadecimal, you can use the remainder method. Divide 221 by 16:

Divide 221/16 = Q:D(13 in decimal), R:D(13 in decimal)

Divide D/16 = Q:0, R:D(13 in decimal)

The final quotient is 0 and the remainders are D and D.

The hexadecimal representation is DD.

4. 145

To convert to hexadecimal, you can use the remainder method. Divide 145 by 16:

Divide 145/16 = Q:9, R:1

Divide 9/16 = Q:0, R:9

The final quotient is 0 and the remainders are 1 and 9.

The hexadecimal equivalent is 91.

b. Binary representation（）

1. 39

To convert to binary, you can use the remainder method and divide 39 by 2 repeatedly and note down remainders:

39 / 2 = 19 with a remainder of 1

19 / 2 = 9 with a remainder of 1

9 / 2 = 4 with a remainder of 1

4 / 2 = 2 with a remainder of 0

2 / 2 = 1 with a remainder of 0

1 / 2 = 0 with a remainder of 1

Reading the remainders from bottom to top, the 8-bit binary representation is 00100111

2. 78

78 / 2 = 39 with a remainder of 0

39 / 2 = 19 with a remainder of 1

19 / 2 = 9 with a remainder of 1

9 / 2 = 4 with a remainder of 1

4 / 2 = 2 with a remainder of 0

2 / 2 = 1 with a remainder of 0

1 / 2 = 0 with a remainder of 1

Reading the remainders from bottom to top, the 8-bit binary representation is 01001110.

3. 221

221 / 2 = 110 with a remainder of 1

110 / 2 = 55 with a remainder of 0

55 / 2 = 27 with a remainder of 1

27 / 2 = 13 with a remainder of 1

13 / 2 = 6 with a remainder of 1

6 / 2 = 3 with a remainder of 0

3 / 2 = 1 with a remainder of 1

1 / 2 = 0 with a remainder of 1

Reading the remainders from bottom to top, the 8-bit binary representation is 11011101.

4. 145

145 / 2 = 72 with a remainder of 1

72 / 2 = 36 with a remainder of 0

36 / 2 = 18 with a remainder of 0

18 / 2 = 9 with a remainder of 0

9 / 2 = 4 with a remainder of 1

4 / 2 = 2 with a remainder of 0

2 / 2 = 1 with a remainder of 0

1 / 2 = 0 with a remainder of 1

Reading the remainders from bottom to top, the 8-bit binary representation is 10010001.

2. [10] Using Number Set #2 (four binary numbers) 11101101b, 00011011b, 11110101b, 01100100b, show the value of each number as:

a. An unsigned decimal value (CALCULATIONS IN OTHER PDF NAMES calculations.pdf)

11101101b = 237

00011011b = 27

11110101b = 245

01100100 = 100

b. A signed decimal value

11101101b = -20

00011011b = 27

11110101b = -19

01100100 = 100

3. [10] Using Number Set #2 (four binary numbers) 01100100b, 10011010b, 01101101b, 11000110b, where the first number is considered to be A, the second number B, the third C, etc… calculate each of the following:

a) A v B, A v C, A v D ( v is the symbol for the OR operation)

A v B = 01100100b v 10011010b = 11111110b

A v C = 01100100b v 01101101b = 01101101b

A v D = 01100100b v 11000110b = 11100110b

b) A ^ B, A ^ C, A ⊕ D (^ is the symbol for the AND operation, ⊕ is the symbol for the XOR operation)

A ^ B = 01100100b ^ 10011010b = 00000000b

A ^ C = 01100100b ^ 01101101b = 01100100b

A ⊕ D = 01100100b ⊕ 11000110b = 10100010b

4. [10] Using Number Set#3 - HEX 71AF2523h, 2B988398h, 9E5E4AD8h, 6B7C3487h (four hexadecimal numbers) where the first number is Q, the second number R, the third S, etc… calculate each of the following:

a) Q + R, Q + S, Q + T (show the carry value – 9th digit, if there is a carry value)

METHOD 1:

Q + R:  
Q = 71AF2523h = 1930950275 decimal  
R = 2B988398h = 731113240 decimal  
Q + R = 1930950275 + 731113240 = 2662063515 decimal  
Converted back to hexadecimal: 9E3F674Bh  
There is no carry.

Q + S:  
Q = 71AF2523h = 1930950275 decimal  
S = 9E5E4AD8h = 1661154136 decimal  
Q + S = 1930950275 + 1661154136 = 3592104411 decimal  
Converted back to hexadecimal: D6FD6DC3h  
There is no carry.

Q + T:  
Q = 71AF2523h = 1930950275 decimal  
T = 6B7C3487h = 1803720967 decimal  
Q + T = 1930950275 + 1803720967 = 3734671242 decimal  
Converted back to hexadecimal: DEEE599Ah  
There is no carry.

METHOD 2:

1. Q+R:

71AF2523

+ 2B988398

\_\_\_\_\_\_\_\_\_\_

9D3789BB

1. Q+S

71AF2523  
+ 9E5E4AD8  
\_\_\_\_\_\_\_\_\_\_  
1100D7FB

1. Q+T:

71AF2523  
+ 6B7C3487  
\_\_\_\_\_\_\_\_\_\_  
DD2B59AA

b) Q – R, Q – S, Q – T (use the TWO’s complement method)

METHOD 1:

1.

Q - R = 71AF2523h - 2B988398h = 71AF2523h + D4677C68h = 46179A8Bh (no carry)

2.   
Q - S = 71AF2523h - 9E5E4AD8h = 71AF2523h + 619B B527h + 1 = D39A7F4Bh (carry 1)

3.  
Q - T = 71AF2523h - 6B7C3487h = 71AF2523h + 9483CB78h + 1 = 0A32F09Ch (carry 1)

METHOD 2:

Q - R:  
  
Two's complement of R: D4677C68h  
Q + (-R) = 71AF2523h + D4677C68h = 11605218Bh (no carry)  
Q - S:  
  
Two's complement of S: 61A1B528h  
Q + (-S) = 71AF2523h + 61A1B528h = D35E77ABh (carry 1)  
Q - T:  
  
Two's complement of T: 9483CB79h  
Q + (-T) = 71AF2523h + 9483CB79h = 0162F09A2h (no carry)