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

2. Q+S

71AF2523
+ 9E5E4AD8
____
1100D7FB

3. 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)