Afifah Arif

# Written Assignment 1

# 50 points

Write out your answers to these problems neatly in a text file and submit your work by the due date.

Be sure to put your name on your paper.

Show your work!

Note: Only problem 6 involves two's-complement notation.

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1. (8 points) Convert the following binary numbers to their decimal representations:
    1. 1001 → (1*2^3)+(1*2^0)= 9
    2. 10110 → (1*2^4)+(1*2^2)+(1*2^1)= 22
    3. 101110 → (1*2^5)+(1*2^3)+(1*2^2)+(1*2^1)= 46
    4. 101011 → (1*2^5)+(1*2^3)+(1*2^1)+(1*2^0)= 43
2. (8 points) Convert the following hexadecimal numbers to their decimal representations:
    1. 3C → (3*16^1)(12*16^0)= 60
    2. A9 → (10*16^1)(9*16^0)= 169
    3. 4E8 → (4*16^2)(14*16^1)(8*16^0)= 1256
    4. 507 → (5*16^2)(0*16^1)(7*16^0)= 1287
3. (8 points) Convert the following decimal numbers to their hexadecimal and binary representations:
    1. 37 → 37-(1*2^5)-(1*2^2)-(1*2^0)= 0010(2) 0101(5)
    2. 1194 → 1194-(1*2^10)-(1*2^7)-(1*2^5)-(1*2^3)-(1*2^1)= 0100(4) 1010(A) 1010(A)
    3. 359 → 359-(1*2^8)-(1*2^6)-(1*2^5)-(1*2^2)-(1*2^1)-(1*2^0)= 0001(1) 0110(6) 0111(7)
    4. 2047 → 2047-(1*2^10)-(1*2^9)-(1*2^8)-(1*2^7)-(1*2^6)-(1*2^5)-(1*2^4)-(1*2^3)-(1*2^2) -(1*2^1)-(1*2^0)= 1111(F) 1111(F) 1111(F)

4. (8 points) Do the binary arithmetic:
    1. 01110

```
  + 11011
  ------------------
   101001
```

2.
```
    10110
  + 01111
  ------------------
   100101
```

3.
```
    10101
  - 01100
  ------------------
     1001
```

4.
```
    11101
  - 01110
  ------------------
     1111
```

5. (8 points) Do the hexadecimal arithmetic:
   1.
   ```
     2581
   + 94BD
   ------------------
     BA3E
   ```

   2.
   ```
     F28
   +  31C
   ------------------
     1244
   ```

   3.
   ```
     5BE7
   -  36C1
   ------------------
     2526
   ```

   4.
   ```
    EAB
  - B84
  ------------------
     327
   ```

6. (6 points) The integers in the following computations are indicated in hexadecimal, but represent 32-bit two's complement binary numbers. Perform the operations and indicate if overflow occurs and why. (If overflow occurs the result is invalid, but show it anyway.)

   a. D4C3B2A1  b. 754C4612

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```
 + 3456ABCD          + 1003A642
 ----------          ----------
 1091A5E6E            854FEC54

    1111                 111
     1101                0111
  +  0011              +  0001
  ---------           ---------
   10000                1000
  (bits match,        (bits match,
  no overflow)         no overflow)
```

```
c. E044032F         d. 645C2041
 - A18492A2          - 781D30B1
----------          ----------
  3EBF708D           -2C3EEF90

    E044032F            645C2041
 +  3EBF708D         + (-2C3EEF90)
----------          ----------
  11F0373BC            381D30B1

    111                  11
     1110                0110
  +  0011              + 0010
  ---------           ---------
   10001                1000

  (bits match,         (bits match,
  no overflow)         no overflow)
```

```
e. 7FFFFFFF         f. E8866541
 + 70000001          -  920B011F
 ----------          ----------
   F0000000            567B6422
 E044032F            E8866541
 +  3EBF708D         + 567B6422
----------          ----------
  11F0373BC           13F01C963
```

```
  111                  11
   0111                 1110
+  0111               + 0101
-------------        -------------
   1110                 10011
(bits match,         (bits match,
 no overflow)         no overflow)
```

7. (4 points) Assume that:
    1. Register 0 contains 00043E6C
    2. Register 1 contains 0000007D
    3. Register 7 contains FF028CC4

Here are some expressions which may be D(X,B) addresses. If they are valid, calculate the values (in hexadecimal), and if they are not valid, explain why not:

4. 38(0,1) → 38-(1*2^5)-(1*2^2)-(1*2^1)= 0010(2) 0110(6)

```
    0000007D
+         26
------------------
    000000A3
```

5. 0(0,7,1) → not valid because there is an extra character
6. 117(0,7) → 117-(1*2^6)-(1*2^5)-(1*2^4)-(1*2^2)-(1*2^0)= 0111(7) 0101(5)

```
   FF028CC4
+         75
------------------
   FF028D39
```

7. 49(7,1) → 49-(1*2^5)-(1*2^4)-(1*2^0)= 0011(3) 0001(1)

```
  FF028CC4
   0000007D
+       31
------------------
  FF028D72
```