First Name: _____   Last Name: _____

For full credit, you need to show your work neatly and box your answers.

20 PT.
1. Convert the following numbers with the indicated bases to decimal:
    a. $(4310)_6$
    b. $(19C)_{14}$
    c. $(1E.8)_{16}$
    d. $(26.24)_8$

12 PT.
2. Convert $(1838.36)_{10}$ to the following bases:
    a. 16
    b. 8
    c. 2
    d. 12

15 PT.
3. Convert the following binary numbers to hexadecimal, octal and decimal.
    a. 101101.101
    b. 101.010
    c. 1010.101

12 PT.
4. Find the 9th and 10th complement of following decimal numbers
    a. 9815634
    b. 7204870
    c. 10000000
    d. 00000000

4 PT.
5. Find the 16th complement of $(ACB3.B2)_{16}$

20 PT.
6. Perform subtraction on the following unsigned binary numbers using the 2's complement of the subtrahend. If the result should be negative, 2's complement it and affix a minus sign.
    a. 11011 – 10111
    b. 100100 – 10101
    c. 101001 – 110000
    d. 101010 - 101011

20 PT.
7. What does the following binary numbers represent in
    a. Unsigned domain
    b. Signed magnitude
    c. Signed 2's complement
    I.   01011101
    II.   11011100
    III. 11111111

12 PT.

8. Perform the following operations in binary. Assume signed 2's complement notation.
     a. $54 + 72$
     b. $54 - 72$
     c. $72 - 54$
     d. $(-72) - (-54)$

15 PT.

9. Perform the following arithmetic operations in the indicated bases.
     a. $(23.6)_8 \times (76.5)_8$
     b. $(23.6)_{12} \times (76.5)_{12}$
     c. $(23.6)_{16} \times (76.5)_{16}$

<div align="center">Due Date: 2/18/2023</div>

①

a. $(4\overset{3}{3}\overset{2}{1}\overset{1}{0})_6 = 4 \times 6^3 + 3 \times 6^2 + 1 \times 6 + 0$

$$= (978)_{10}$$

b. $(\overset{2}{1}\overset{1}{9}\overset{0}{C})_{14} = 1 \times 14^2 + 9 \times 14 + 12 \times 14^0$

$$= (334)_{10}$$

c. $(\overset{1}{1}\overset{0}{E}.\overset{-1}{8})_{16} = 1 \times 16 + 14 + 8 \times 16^{-1}$

$$= (30.5)_{10}$$

d. $(\overset{1}{2}\overset{0}{6}.\overset{-1}{2}\overset{-2}{4})_8 = 2 \times 8 + 6 \times 8^0 + 2 \times 8^{-1} + 4 \times 8^{-2}$

$$= (22.31)_{10}$$

2. $(1838.36)_{10}$

1024	512	256	128	64	32	16	8	4	2	1		.5	.25	0.125
1	1	1	0	0	⊄	0	1	1	1	0	.	0	1	1

a. $(72E.6\overset{05}{6})_{16}$

b.

$\underbrace{011}_{3}\underbrace{100}_{4}\underbrace{101}_{5}\underbrace{110}_{6}.\underbrace{011}_{3}$

$(3456.3)_8$

c. $1111 0010 1110.011$

d.

$1838 \div 12 = 153. \quad R_0 = 2$
$153 \div 12 = 12 \quad R_1 = 9$
$12 \div 12 = 1 \quad R_2 = 0$
$1 \div 12 = 0 \quad R_3 = 1$

$.36 \times 12 = 4.32$
$.32 \times 12 = 3.84$

$(1092.43)_{12}$

3.

a. 0010 1101 . 1010

$(2 \quad D \quad . \quad A)_{16}$

101, 101, . 101,

b. $(5 \quad 5 \quad . \quad 5)_8$

32 16 8 4 2 1 .5 .25 .125
1 0 1 1 0 1 . 1 0 1

$(45.625)_{10}$

b.

0 101 . 01 00

$(5.4)_{16}$

101 . 010

$(5.2)_8$

4 2 1 .5 .25
1 0 1 . 0 1

$(5.25)_{10}$

C.

$\underbrace{1010}_{A} . \underbrace{1010}_{A})_{16}$

$\underbrace{00\ 1010}_{1\ 2} . \underbrace{101}_{5})_{8}$

8 42 1 .5 .25 .125
1010 . 101

$(10 . 625)_{10}$

4.a/
```
  9 9 9 9 9 9 9
- 9 8 1 5 6 3 4
```
9th 1 8 4 3 6 5
                1
10th 1 8 4 3 6 6

b/
```
  9 9 9 9 9 9 9
  7 2 0 4 8 7 0
```
9th 2 7 9 5 1 2 9
                1
  2 7 9 5 1 3 0

c/   99999999
   − 10000000
   _____
9th 89999999
              1
   _____
10th 90000000

d/   99999999
     00000000
   _____
9th 99999999
              1
   _____
10th 00000000

5.   FFFF.FF
       − ACB3.B2
15th _____
       534C.4D
              1
16th _____
       534C.4E

6/
a/   11011   11011
   − 10111   2'sComp   →   + 01001
                            _____
                             00100
                         ↳ cy=1 result pos.

b/   100100   100100
   − 010101   2/s Comp →   + 101011
   _____   _____
                            00111 1
                         ↳ cy=1 result is pos.

5

c.   101001

− 0110000 $\xrightarrow[\text{Comp}]{2's}$

101001

010000

―――――

111001

↳ CY=0   Neg.

− 000111

d.   101010

− 101011 $\xrightarrow[\text{Comp}]{2's}$

101010

010101

―――――

111111

↳ CY=0 Neg

− 000001

7/ I. 01011101

a. Unsighed

128 64 32 16 8 4 2 1

01011101

93

b.

93

c.

93

II.

II. 11011100

   a.
$$\overset{128\ \ 64\ 32\ 16\ 8\ 4\ 2\ 1}{1\ 1\ 0\ 1\ 1\ 1\ 0\ 0}$$

      $(220)_{10}$

   b.   − 92

   c. $\overset{32\ 16\ 8\ 4\ 2\ 1}{-0\ 0\ 1\ 0\ 0\ 1\ 0\ 0}$

      − 36

III.

      1111 1111

   a. $\overset{128\ 64\ 32\ 16\ 8\ 4\ 2\ 1}{1\ 1\ 1\ 1\ \ 1\ 1\ 1\ 1}$

      $(255)_{16}$

   b. − 127

   c. −1

8/

$$S\ 64\ 32\ 16\ 8\ 4\ 2\ 1$$

$54 \rightarrow$ 0 0 1 1 0 1 1 0

-54 1 1 0 0 1 0 1 0

72 0 1 0 0 1 0 0 0

-72 1 0 1 1 1 0 0 0

a. $54 + 72$

```
  0 0 1 1 0 1 1 0
+ 0 1 0 0 1 0 0 0
_____
  0 1 1 1 1 1 1 0
```

b. $54 - 72$

```
  0 0 1 1 0 1 1 0
+ 1 0 1 1 1 0 0 0
_____
  1 1 1 0 1 1 1 0
```

c. $72 - 54$

```
  0 1 0 0 1 0 0 0
+ 1 1 0 0 1 0 1 0
_____
  0 0 0 1 0 0 1 0
```
$\hookrightarrow cy = 1$

d/

```
  1 0 1 1 1 0 0 0
  0 0 1 1 0 1 1 0
  ─────────────────
  1 1 1 0 1 1 1 0
```

9.
$(23.6)_8$
$\times (76.5)_8$

```
  1   4 2 6
  1   6 6 4
2 1   2 2
─────────────────
(2 3  2 4.6 6)_8
```

$30 \div 8 = 3 \quad R=6$
$18 \div 8 = 2 \quad R=2$
$12 \div 8 = 1 \quad R=4$
$36 \div 8 = 4 \quad R=4$
$22 \div 8 = 2 \quad R=6$
$14 \div 8 = 1 \quad R=6$
$42 \div 8 = 5 \quad R=2$
$26 \div 8 = 3 \quad R=2$
$17 \div 8 = 2 \quad R=1$

b/ ~~23~~

$(23.6)_{12}$
$\times (76.5)_{12}$

```
      2   B   5 6
  1   1   9   0
  1   4   0 6
──────────────────
( )  5 3  2.5 6)_{12}
```

$30 \div 12 = 2 \quad R=6$
$17 \div 12 = 1 \quad R=5$
$36 \div 12 = 3 \quad R=0$
$21 \div 12 = 1 \quad R=9$
$13 \div 12 = 1 \quad R=1$
$42 \div 12 = 3 \quad R=6$
$24 \div 12 = 2 \quad R=0$
$16 \div 12 = 1 \quad R=4$
$26 \div 12 = 2 \quad R=2$

c/ $(23.6)_{16}$

$\times\ (76.5)_{16}$

_____

$+$ B   o   Đ

    D   4   4

F   7   A

_____

$(1\ 0\ 5\ 9\ .\ 4\ E)_{16}$

$30 \div 16 = 1 \quad R = 14$

$16 \div 16 = 1 \quad R = 0$

$36 \div 16 = 2 \quad R = 4$

$20 \div 16 = 1 \quad R = 4$

$42 \div 16 = 2 \quad R = 10$

$23 \div 16 = 1 \quad R = 7$

$25 \div 16 = 1 \quad R = 9$

$21 \div 16 = 1 \quad R = 5$