ITI 1100C ASSIGNMENT 1 SOLUTIONS

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1.3) Total points: 12.5%
Conversion to Decimal
a) $(4310)_5 = 4 \times 5^3 + 3 \times 5^2 + 1 \times 5^1 + 0 \times 5^0 = (\mathbf{580})_{\mathbf{10}}$ 3.125%
b) $(198)_{12} = 1 \times 12^2 + 9 \times 12^1 + 8 \times 12^0 = (\mathbf{260})_{\mathbf{10}}$ 3.125%
c) $(435)_8 = 4 \times 8^2 + 3 \times 8^1 + 5 \times 8^0 = (\mathbf{285})_{\mathbf{10}}$ 3.125%
d) $(345)_6 = 3 \times 6^2 + 4 \times 6^1 + 5 \times 6^0 = (\mathbf{137})_{\mathbf{10}}$ 3.125%

1.7) Total points: 6.25%
i) Conversion of $(64CD)_{16}$ to Binary 3.125%

6	4	C	D	Hexadecimal
0110	0100	1100	1101	Binary

Therefore, $(64CD)_{16} = (\mathbf{0110\ 0100\ 1100\ 1101})_{\mathbf{2}}$

ii) Conversion from Binary to Octal 3.125%
Group the bits in 3s, starting from Least Significant Bit (LFB):

000	110	010	011	001	101	Binary
0	6	2	3	1	5	Octal

Therefore, $(0110\ 0100\ 1100\ 1101)_2 = (\mathbf{62315})_{\mathbf{8}}$

1.9) Total points: 15.625%

a) $(10110.0101)_2$

$= 1 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 0 \times 2^0 + 0 \times 2^{-1} + 1 \times 2^{-2} + 0 \times 2^{-3} + 1 \times 2^{-4}$

$= (\mathbf{22.3125})_{\mathbf{10}}$ 3.125%

b)$(16.5)_{16} = 1 \times 16^1 + 6 \times 16^0 + 5 \times 16^{-1} =$

$(\mathbf{22.3125})_{\mathbf{10}}$ 3.125%

c) $(26.24)_8 = 2 \times 8^1 + 6 \times 8^0 + 2 \times 8^{-1} + 4 \times 8^{-2}$

$= (\mathbf{22.3125})_{\mathbf{10}}$ 3.125%

d) $(DADA.B)_{16} = 13 \times 16^3 + 10 \times 16^2 + 13 \times 16^1 + 10 \times 16^0 + 11 \times 16^{-1}$

$= (\mathbf{56026.6875})_{\mathbf{10}}$ 3.125%

e) $(1010.1101)_2 =$

$1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 0 \times 2^0 + 1 \times 2^{-1} + 1 \times 2^{-2} + 0 \times 2^{-3} + 1 \times 2^{-4} =$

$(\mathbf{10.8125})_{\mathbf{10}}$ 3.125%

1.13) Total points: 12.5%

a) Conversion of $(27.315)_{10}$ to Binary

Integer Part: $(27)_{10}$ 1.5625%

Division by 2	Integer Quotient	Remainder
27/2	13	$a_0 = 1$
13/2	6	$a_1 = 1$
6/2	3	$a_2 = 0$
3/2	1	$a_3 = 1$
1/2	0	$a_4 = 1$

Therefore,$(\mathbf{27})_{\mathbf{10}} = (\mathbf{11011})_{\mathbf{2}}$

Fraction Part: $(0.315)_{10}$ 1.5625%

Multiplication by 2	Integer	Fraction
0.315x2	$a_{-1} = 0$	0.630
0.630x2	$a_{-2} = 1$	0.260
0.260x2	$a_{-3} = 0$	0.520
0.520	$a_{-4} = 1$	0.040
...	...	...
...	...	...

Therefore, $(\mathbf{0.315})_{\mathbf{10}} \simeq (\mathbf{0.0101}...)_{\mathbf{2}}$

Combining the Integer and Fraction parts we get $(\mathbf{11011.0101})_{\mathbf{2}}$

1.13)

b) Conversion of $(2/3)_{10}$ to Binary (8 decimal places) 1.5625%

$(2/3 \simeq 0.6666666667)$

Multiplication by 2	Integer	Fraction
0.6666666667x2	$a_{-1} = 1$	0.3333333334
0.3333333334x2	$a_{-2} = 0$	0.6666666668
0.6666666668x2	$a_{-3} = 1$	0.3333333336
0.3333333336x2	$a_{-4} = 0$	0.6666666672
0.6666666672x2	$a_{-5} = 1$	0.3333333344
0.3333333344x2	$a_{-6} = 0$	0.6666666688
0.6666666688x2	$a_{-7} = 1$	0.3333333376
0.3333333376x2	$a_{-8} = 0$	0.6666666752

Therefore, $(\mathbf{0.6666666667_2}) \simeq (\mathbf{0.10101010})_{\mathbf{2}}$

Converting the Binary number back to decimal: 1.5625%

$(0.10101010)_2 =$

$1 \times 2^{-1} + 0 \times 2^{-2} + 1 \times 2^{-3} + 0 \times 2^{-4} + 1 \times 2^{-5} + 0 \times 2^{-6} + 1 \times 2^{-7} + 0 \times 2^{-8} =$

$(\mathbf{0.6640625})_{\mathbf{10}}$

To find out how close the result is to $(2/3)_{10}$, you could find the difference between them

$(2/3)_{10} \simeq (0.6666667)_{10}$

$(2/3)_{10} - (0.6640625)_{10} \simeq (0.6666667)_{10} - (0.6640625)_{10} \simeq (\mathbf{0.0026042})_{\mathbf{10}}$

c) Conversion from $(0.10101010)_2$ to Hexadecimal 1.5625%

0.	1010	1010	Binary
0.	A	A	Hexadecimal

Therefore, $(\mathbf{0.10101010})_{\mathbf{2}} = (\mathbf{0.AA})_{\mathbf{16}}$

Conversion of $(0.AA)_{16}$ to decimal 1.5625%

$(0.AA)_{16} = 10 \times 16^{-1} + 10 \times 16^{-2} = (\mathbf{0.6640625})_{\mathbf{10}}$

The result is the same as in 1.13)b)

1.14) Total points: 12x1.5625%=18.750%

We can find the 1's and 2's complements directly as described in Pages 46,47 and 48 of Chapter1 lecture notes

	Binary Number	1's Complement	2's Complement
a)	00010000	11101111	11110000
b)	00000000	11111111	[1]00000000
c)	11011010	00100101	00100110
d)	10101010	01010101	01010110
e)	10000101	01111010	01111011
f)	11111111	00000000	00000001

1.16) Total points: 12.5%

a) 16's complement: 3.125%

$(C3DF)_{16} = (10000)_{16} - (C3DF)_{16} = (\mathbf{3C21})_{\mathbf{16}}$

b) Converting to Binary 3.125%

C	3	D	F	Hexadecimal
1100	0011	1101	1111	Binary

Therefore, $(\mathbf{C3DF})_{\mathbf{16}} = (\mathbf{1100\ 0011\ 1101\ 1111})_{\mathbf{2}}$

c) Using quick way of finding 2's complement (described in Pages 46,47, and 48 of Chapter1 lecture notes): 3.125%

2's complement of $(1100\ 0011\ 1101\ 1111)_2 = (\mathbf{0011\ 1100\ 0010\ 0001})_{\mathbf{2}}$

d) Converting $(0011\ 1100\ 0010\ 0001)_2$ to hexadecimal 3.125%

0011	1100	0010	0001	Binary
3	C	2	1	Hexadecimal

The result is the same as in (a)

1.17) Total points: 12.5%

When adding or subtracting numbers in any base, make sure they have the same number of digits.For example, if A=675, and B=8920, then A-B=**0**675-8920.

a) 4637-2579 3.125%

10's complement of 2579=$10000 - 2579 = \mathbf{7421}$

Therefore, $4637 - 2579 = 4637 + \mathbf{7421} = [1]2058$

Discard the carry bit

Result=**2058**

Verification: 4637-2579=2058

b) 125-1800 3.125%

10's complement of 1800=$10000 - 1800 = \mathbf{8200}$

Therefore, $125 - 1800 = 0125 + \mathbf{8200} = 8325$

The result has no carry (negative), therefore take 10's complement.

10's complement of 8325=$10000 - 8325 = \mathbf{1675}$

Result=$-\mathbf{1675}$

Verification: 125-1800=-1675

c) 2043-4361 3.125%

10's complement of 4361=$10000 - 4361 = \mathbf{5639}$

Therefore, $2043 - 4361 = 2043 + \mathbf{5639} = 7682$

The result has no carry (negative), therefore take 10's complement.

10's complement of 7682=$10000 - 7682 = \mathbf{2318}$

Result=$-\mathbf{2318}$

Verification: 2043-4361=-2318

d) 1631-745 3.125%

1631 has 4 digits, while 745 has 3. Both numbers must have the same number of digits, therefore 745=**0745**

10's complement of 0745=$10000 - 0745 = \mathbf{9255}$

Therefore, $1631 - 745 = 1631 - 0745 = 1631 + \mathbf{9255} = [1]0886$

Discard the carry bit

Result=**0886**

Verification: 1631-745=886

1.18) Total points: 12.5%

a) 10011-10010 3.125%

2's complement of 10010=**01110**

Therefore, $10011 - 10010 = 10011 + \mathbf{01110} = [1]00001$

Discard the carry bit

Result=**00001**

b) 100010-100110 3.125%

2's complement of 100110=**011010**

Therefore, $100010 - 100110 = 100010 + \mathbf{011010} = 111100$

The result has no carry (negative), therefore take 2's complement.

2's complement of 011010=**000100**

Result=$-$**000100**

c) 1001-110101 3.125%

2's complement of 110101=**001011**

Therefore, $1001 - 110101 = 001001 - 110101 = 001001 + 001011 = 010100$

The result has no carry (negative), therefore take 2's complement.

2's complement of 010100=**101100**

Result=$-$**101100**

d) 101000-10101 3.125%

10101=010101

2's complement of 010101=**101011**

Therefore, $101000 - 10101 = 101000 - 010101 = 101000 + 101011 = [1]010011$

Discard the carry bit

Result=**010011**