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EIE2050 Assignment 1

2. (a) $100001_{(2)} = 1\cdot2^5+0+0+0+0+1\cdot2^0{}_{(10)}$
$= 33_{(10)}$

(b) $100111_{(2)} = 1\cdot2^5+0+0+1\cdot2^2+1\cdot2^1+1\cdot2^0{}_{(10)}$
$= 39_{(10)}$

(c) $101010_{(2)} = 1\cdot2^5+0+1\cdot2^3+0+1\cdot2^1+0$
$= 42_{(10)}$

(d) $111001_{(2)} = 1\cdot2^5+1\cdot2^4+1\cdot2^3+0+0+1\cdot2^0$
$= 57_{(10)}$

3. (e) $65_{(10)} = 2^6+2^0{}_{(10)} = 1000001_{(2)}$

(f) $97_{(10)} = 2^6+2^5+2^0{}_{(10)} = 1100001_{(2)}$

(g) $127_{(10)} = 2^6+2^5+2^4+2^3+2^2+2^1+2^0{}_{(10)} = 1111111_{(2)}$

(h) $198_{(10)} = 2^7+2^6+2^2+2^1{}_{(10)} = 11000110_{(2)}$

4. (a) $0.26_{(10)} = 2^{-2}+2^{-7}+2^{-9}+\varepsilon_{(10)} = 0.010000101\ldots_{(2)}$

(b) $0.762_{(10)} = 2^{-1}+2^{-2}+2^{-7}+2^{-8}+\varepsilon_{(10)} = 0.110000110..._{(2)}$

(c) $0.0975_{(10)} = 2^{-4}+2^{-5}+2^{-9}+\varepsilon_{(10)} = 0.000110001\ldots_{(2)}$

5. (e) $\underbrace{101010}_{\text{invert}} \xrightarrow[\text{2's complement}]{\text{convert}} 010110$

(f) $\underbrace{11001}_{\text{invert}} \xrightarrow[\text{2's complement}]{\text{convert}} 00111$

(g) $\underbrace{11001100}_{\text{invert}} \xrightarrow[\text{2's complement}]{\text{convert}} 00110100$

(h) $\underbrace{11000111}_{\text{invert}} \xrightarrow[\text{2's complement}]{\text{convert}} 00111001$

6. (a) $10011001_{(2)} = -2^7+2^4+2^3+2^0{}_{(10)} = -103_{(10)}$

(b) $01110100_{(2)} = 2^6+2^5+2^4+2^2{}_{(10)} = 116_{(10)}$

(c) $10111111_{(2)} = -2^7+2^5+2^4+2^3+2^2+2^1+2^0{}_{(10)} = -65$

7. (a)
$$\begin{array}{r} 00010110_{(2)} \\ 00110011_{(2)} + \\ \hline 01001001_{(2)} \end{array}$$

(b)
$$\begin{array}{r} 01110000_{(2)} \\ 10101111_{(2)} + \\ \hline \underbrace{1}_{\text{ignored}}0001111\,11_{(2)} \end{array} = 00011111_{(2)}$$

8. (a) $00110011 - \underbrace{00010000}_{\text{invert}}{}_{(2)} = 00110011_{(2)}$
$11110000_{(2)}+$
$\underbrace{1}_{\text{ignored}}00100011_{(2)}$
$= 00100011_{(2)}$

(b) $01100101 - \underbrace{11101000}_{\text{invert}}{}_{(2)} :$
$01100101_{(2)}$
$00011000_{(2)} +$
$01111101_{(2)}$

9. $10001000_{(2)} \div 00100010_{(2)}$
(−) (+)

$10001000_{(2)}$ Add 1 to quotient
$11011110_{(2)}+$
$\underbrace{1}_{\text{ignored}}01100110_{(2)}$ Add 1 to quotient
$11011110_{(2)}+$
$\underbrace{1}_{\text{ignored}}01000100_{(2)}$ Add 1 to quotient
$11011110_{(2)}+$
$\underbrace{1}_{\text{ignored}}00100010_{(2)}$ Add 1 to quotient
$11011110_{(2)}+$
$\underbrace{1}_{\text{ignored}}00000000_{(2)}$

quotient $= -4_{(10)} = 11111100_{(2)}$

10. (a) $1111_{(2)} = F_{16}$

(b) $1011_{(2)} = B_{16}$

(c) $\underbrace{0001}\ \underbrace{1111}_{(2)} = 1F_{16}$

11 (a) $60_{(16)} - 39_{(16)} = 27_{(16)}$

(b) $A5_{(16)} - 98_{(16)} = D_{(16)}$

(c) $F1_{(16)} - A6_{(16)} = 4B_{(16)}$

(d) $AC_{(16)} - 10_{(16)} = 9C_{(16)}$

12 (a) $0010_{(BCD)} + 0001_{(BCD)} = 2_{(10)} + 1_{(10)} = 0011_{(BCD)}$

(b) $0101_{(BCD)} + 0011_{(BCD)} = 5_{(10)} + 3_{(10)} = 1000_{(BCD)}$

(c) $0111_{(BCD)} + 0010_{(BCD)} = 7_{(10)} + 2_{(10)} = 1001_{(BCD)}$

(d) $1000_{(BCD)} + 0001_{(BCD)} = 8_{(10)} + 1_{(10)} = 1001_{(BCD)}$

13. 30 INPUT A, B

51 48 32 73 78 80 85 84 032 065 044 032 066

00110011 00110000 00100000 01001001 01001110 01010000 01010101
01010100 00100000 01000001 00101100 00100000 01000010

14. (a) 11110110 $\longrightarrow (1+1+1+1+0+1+1+0) \bmod 2 = 0$ (ERROR)

(b) 00110001 $\longrightarrow (0+0+1+1+0+0+0+1) \bmod 2 = 1$ (NO ERROR)

(c) 0101010101010101 $\rightarrow (0+1+0+1+0+1+0+1+0+1+0+1+0+1+0+1) \bmod 2 = 0$ (ERROR)

15. 10110010 $\longrightarrow$ 10110010 0000

add 0000

10110010 0000

1010 ⊕

1001

1010 ⊕

1100

1010 ⊕

1100

1010 ⊕

1100

1010 ⊕

1100

1010 ⊕

110

$\Rightarrow$ Transmitted value is 10110010110