CIS102 Tutorial 1 Answers

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October 10 2006

1. (a) $4037 = 4(10^3)+0(10^2)+3(10^1)+7(10^0)$
   $40371 = 4(10^4)+0(10^3)+3(10^2)+7(10^1)+1(10^0)$

   (b) $abcd = 10^3a+10^2b+10^1c+10^0d$
   $abcd1 = 10^4a+10^3b+10^2c+10^1d+1(10^0)$
   $x = 10n+1$

   (c) $111011_2 = 1(2^5)+1(2^4)+1(2^3)+0(2^2)+1(2^1)+1(2^0) = 59_{10}$
   $1110110_2 = 1(2^6)+1(2^5)+1(2^4)+0(2^3)+1(2^2)+1(2^1)+0(2^0) = 2\times 59_{10} = 118_{10}$
   $111111111_2 = 1000000000_2 - 1_2 = 2^9 - 1 = 512_{10} - 1_{10} = 511_{10}$

2. (a)

				1	0	1	1	1
+			1	1	1	0	1	0
		1	0	1	0	0	0	1

		1	1	0	0	0	0	
−			1	0	1	1	1	
			1	1	0	0	1	

					1	1	0	1
				×	1	1	0	1
					1	1	0	1
			1	1	0	1	0	0
		1	1	0	1	0	0	0
1	0	1	0	1	0	0	0	1

   (b) $10111_2 + 111010_2 = 23_{10} + 58_{10} = 81_{10}$
   $111010_2 - 10111_2 = 48_{10} - 23_{10} = 25_{10}$
   $1101_2 \times 1101_2 = 13_{10} \times 13_{10} = 169_{10}$

3. (a) $(A2E)_{16} = A(16^2)+2(16^1)+E(16^0) = 10(16^2)+2(16^1)+14(16^0) = 10\times 256+2\times 16+14\times 1 = 2560+32+14 = 2606$

   (b)

		A	9	4
+		B	6	F
	1	6	0	3

4. (a)

Decimal	Binary
0	000
1	001
2	010
3	011
4	100
5	101
6	110
7	111

   (b) $10111011.101_2 = 273.5_8$
   $53.04_8 = 101011.0001_2$

5. (a) A *rational number* is a number of the form $\frac{m}{n}$ where m, n are integers, $n \neq 0$

   (b) A decimal number is rational if it is terminating (*e.g.* 10.53) or ends in a recurring block (*e.g.* $10.5\dot{3}$)

   (c)
$$\begin{array}{rrcl} & 100x & = & 95.45\dot{4}\dot{5} \\ - & x & = & 0.95\dot{4}\dot{5} \\ \hline & 99x & = & 94.5000 \end{array}$$

   $x = \frac{21}{22}$

6. $0.1011_2 = 1(2^{-1}) + 0(2^{-2}) + 1(2^{-3}) + 1(2^{-4}) = \frac{1}{2} + \frac{1}{8} + \frac{1}{16} = \frac{11}{16} = 0.6875$

7. (a) $753_{10} = 1011110001_2 = 11003_5$

   (b) $B.25_{16} = 11.14453125_{10} = 1011.00010101_2$

   (c) $\frac{5_{10}}{8_{10}} = \frac{101_2}{1000_2} = 0.101_2$

8. $42900 = 2^2 \times 3 \times 5^2 \times 11 \times 13$

9. (a) $0.714 < \frac{5}{7} < 0.715$

   (b) $1.41 \leq \sqrt{2}$

   (c) $1.732 \leq \sqrt{3} \leq 1.7322$

10. $0.0000526 = 0.526 \times 10^{-4}$
    $429000000 = 0.429 \times 10^9$
    $1 = 0.1 \times 10^1$