Tutorial on Number System

1. Evaluate the following arithmetic:

   (a) $111_2 + 101_2$
   (b) $1100\ 1101_2 + 1011\ 0111_2$
   (c) $1001_2 + 1101_2 + 1101_2 + 1011_2$
   (d) $1101.0111_2 + 11011.1011_2$
   (e) $1101011_2 + 1100101_2 + 10011_2$
   (f) $1101_2 - 1011_2$
   (g) $1100_2 - 1001_2$
   (h) $1100\ 1001_2 - 1001\ 1100_2$
   (i) $11001.01101_2 - 1101.10111_2$
   (j) $1101_2 \times 1011_2$
   (k) $110\ 1011_2 \times 10101_2$
   (l) 1101.011_2 x 1.01_2
   (m) $11011_2 \div 11_2$
   (n) $110110_2 \div 1001_2$
   (o) $1001.011_2 \div 10.1_2$

2. Find the ones and twos complement of $1100\ 1100$

3. Evaluate $1111_2 - 1100_2$ using twos complement

4. Find the binary difference of $1110101_2 - 1101001_2$ using 2s complements

5. Find the binary difference of $10101_2 - 11011_2$ using 2s complements

6. Evaluate $10\ 1011_2 - 11\ 0100_2$ using twos complement

7. Evaluate the following arithmetic:

   (a) $75.432_8 + 4.446_8$ (b) $134.63_8 - 77.572_8$ (c) $671354_8 - 213604_8$

8. Evaluate the following arithmetic:

   (a) $AD.1B7_{16} + 1E.8D_{16}$ (b) $F3.D2_{16} - 68.ACE_{16}$

9. State the place value of each underlined bit:

   (a) $10\underline{1}010_2$ (b) $1011.1\underline{0}01_2$ (c) $4\underline{7}.21_{10}$ (d) $A65.E3\underline{B}_{16}$ (e) $\underline{3}57.16_8$

10. Find X by performing the following conversions:

(a) 110.11_2 to X_{10} (b) 809.625_{10} to X_2 (c) $23E.9A_{16}$ to X_2
(d) 255.125_{10} to X_{16} (e) 1100.100100_2 to X_{10} (f) 163_{10} to X_2
(g) 27.72_8 to X_{10} (h) $CE9.D5_{16}$ to X_{10} (i) 7546_{10} to X_8
(j) 109.78125_{10} to X_2 (k) 0.6 to X_2 (l) 684.90625_{10} to X_8
(m) 229.34375_{10} to X_{16} (n) $11101\ 0111\ 1011_2$ to X_8
(o) 672.534_8 to X_2 (p) $1100.1011\ 0110\ 11_2$ to X_{16}
(q) $39.B8_{16}$ to X_{10}

11. Evaluate giving your answer in hexadecimal
$2\mathrm{F}.4_{16} + (1101.1_2 \times 1000.1_2)$.

Answers

1. (a) 1100_2 (b) $1\ 1000\ 0100_2$ (c) $10\,1110_2$ (d) 101001.0010_2
(e) 11100011_2 (f) 10_2 (g) 11_2 (h) $10\,1101_2$
(i) 1011.10110_2 (j) $1000\,1111_2$ (k) $1000\,1100\,0111_2$
(l) 10000.10111_2 (m) 1001_2 (n) 110_2 (o) 11.11_2

2. $0011\,0\,100_2$ 3. $00\,11_2$ 4. 1100_2

5. $-00\,110_2$ 6. -001001_2

7. (a) 102.100_8 (b) 35.036_8 (c) 455550_8

8. (a) $CB.A87_{16}$ (b) $8B.252_{16}$

9. a) 2^3 (b) 2^{-2} (c) 10^0 (d) 16^{-3} (e) 8^2

10. (a) 6.75_{10} (b) 1100101001.101_2 (c) 1000111110.1001101_2
(d) $FF.2_{16}$ (e) 12.5625_{10} (f) 10100011_2
(g) 23.90625_{10} (h) 3305.832031_{10} (i) 16572_8
(j) 1101101.11001_2 (k) $0.10011001....$ (l) 1254.72_8
(m) $E5.58_{16}$ (n) 16573_8 (o) 110111010.101011100_2
(p) $C.\mathrm{B}6\mathrm{C}_{16}$ (q) 57.71875_{10}

11. $A2_{16}$