Hudson LW

Part 1 dec → bin
decimal → binary

a) $10 = 1010_2$ ← base

b) $25 = 11001_2$

c) $42 = 101010_2$

d) $66 = 1000010_2$

e) $105 = 1101001_2$

f) $201 = 11001001_2$

(a)
10
- 8 (2^3)
2
- 2 (2^1)
0

(b)
25
- 16 (2^4)
9
- 8 (2^3)
1
- 1 (2^0)
0

(c)
2 | 42
2 | 21 — 0
2 | 10 — 1
2 | 5 — 0
2 | 2 — 1
2 | 1 — 0
0 — 1

42
- 32 (2^5)
10
- 8 (2^3)
2
- 2 (2^1)
0

101010_2

(d)
2 | 66
2 | 33 — 0
2 | 16 — 1
2 | 8 — 0
2 | 4 — 0
2 | 2 — 0
2 | 1 — 0
0 — 1

(e)
105
- 64 (2^6)
41
- 32 (2^5)
9
- 8 (2^3)
1 (2^0)
- 1
0

(f)
201
- 128 (2^7)
73
- 64 (2^6)
9
- 8 (2^3)
1
- 1 (2^0)
0

$2^0 = 1$
$2^1 = 2$
$2^2 = 4$
$2^3 = 8$
$2^4 = 16$
$2^5 = 32$
$2^6 = 64$
$2^7 = 128$
$2^8 = 256$

Part 2 bin → dec

a) $1110 = 14_{10}$ ← base

b) $1011 = 11_{10}$

c) $10011 = 19_{10}$

d) $10101010 = 170_{10}$

e) $11111000 = 248_{10}$

f) $1111 = 15_{10}$

g) $111111 = 63_{10}$

h) $1111111 = 127_{10}$

i) $11111111 = 255_{10}$

j) Any remarks about the values of f, g, h and i

When we add a 1 to the number, the next number would be the double of number plus 1.

eg. (h) (i)
$(127 \times 2) + 1 = 255$

(a) $2^3 + 2^2 + 2^1 = 14$

(b) $(1)2^3 + (0)2^1 + (1)2^0 = 11$

(c) $(1)2^4 + (0)2^1 + (0)2^0 = 19$

(d) $(1)2^7 + (0)2^5 + (1)2^3 + (0)2^1 = 170$

(e) $(1)2^7 + (1)2^6 + (1)2^5 + (1)2^4 + (1)2^3 = 248$

(f) $(1)2^3 + (1)2^2 + (1)2^1 + (1)2^0 = 15$

(g) $(1)2^5 + (1)2^4 + (1)2^3 + (1)2^2 + 2^1(1) + 2^0(1) = 63$

(h) $(1)2^6 + (1)2^5 + (1)2^4 + (1)2^3 + (1)2^2 + 2^1(1) + 2^0(1) = 127$

(i) $(1)2^7 + (1)2^6 + (1)2^5 + (1)2^4 + 2^3(1) + 2^2(1) + 2^1(1) + 2^0(1) = 255$

Part 3 deci → hexadecimal

a) 16 : 10_{16} ← base

b) 64 : 40_{16}

c) 101 : 65_{16}

d) 106 : $6A_{16}$

e) 255 : FF_{16}

f) 256 = 100_{16}

(a)
16 | 16 — 0 (16×1) Remain 0
16 | 1 — 1 remain
0

(b)
16 | 64 — (16×4) Remain 0
16 | 4 — Remain 4
0

(c)
16 | 101 — (16×6 = 96) Remain 5
16 | 6 — Remain 6
0

(d)
16 | 106 — Remain 10
16 | 6 — Remain 6
0

(e)
16 | 255 — (16×15 = 240) Remain 15
16 | 15 — Remain 15
0

(f)
16 | 256 — (16×16) Remain 0
16 | 16 — Remain 0
16 | 1 — Remain 1

Part 4 hexadec → dec

a) 16 : 22_{dec}

b) 64 = 100_{dec}

c) ABC : 2748_{dec}

d) 3E4 = 996_{dec}

e) 9D6 = 1238_{dec}

f) FF1 = 4081_{dec}

(a) $16 = 1\times16^1 + 6\times16^0$

(b) $64 = 6\times16^1 + 4\times16^0$

(c) $ABC = 10\times16^2 + 11\times16^1 + 12\times16^0$

(d) $3E4 = 3\times16^2 + 14\times16^1 + 4\times16^0$

(e) $9D6 = 9\times16^2 + 13\times16^1 + 6\times16^0$

(f) $FF1 = 15\times16^2 + 15\times16^1 + 1\times16^0$

Part 5 binary → hexadecimal (the table)

a) 1010 = A_{16} (hex)

b) 1101 = D_{16} (hex)

c) 10011001 = 99_{16} (hex)

d) 1000111 = $C7_{16}$ (hex)

e) 11110 = $1E_{16}$ (hex)

f) 1111 = F_{16} (hex)

g) 1010101 = 55_{16} (hex)

h) 1101100111 = 367_{16} (hex)

i) 1010101010000 = $2AA8_{16}$ (hex)

Part 6

a) $1001 + 0101$ (binary) $= 1110_2$

Decimal: $9 + 5 = 14$

Binary $= 1110_2$

$$\begin{array}{r} 1001 \\ +\ 0101 \\ \hline 1110 \end{array}$$

b) $10000000 + 11000000$ (binary)

$= 101000000_2$

$$\begin{array}{r} 10000000 \\ +\ 11000000 \\ \hline 101000000 \end{array} \rightarrow (2^6 \cdot 1) + (2^8 + 1) = 320$$

Dec: $2^7 \cdot 1 = 128$ $\quad (2^6 \cdot 1) + (2^7 \cdot 1) = 64 + 128 = 192$

$$\begin{array}{r} 192 \\ +\ 128 \\ \hline 320_{10} \end{array}$$

c) $1F0 + E1A$ (hexadecimal) $= 100A_{16}$

$$\begin{array}{r} 1F0 \\ +\ E1A \\ \hline 100A \end{array}$$

hex → dec

$16^0 \times 0 + 15 \times 16^1 + 1 \times 16^2 = 496$

$16^0 \times 10 + 1 \times 16^1 + 14 \times 16^2 = 3610$

$496 + 3610 = 4106$

dec → hex

16 | 4106		
16 | 256	10 Remain	
16 | 16	0 Remain	
16 | 1	0 Remain	
0	1 Remain	100A

$(15+1)$

$16 = 1 \times 16 + x$

$x = 0$

$16^1 \times 15 + 16^1 \times 1$

16×16^1

$(16+0) \times 16^1$

$16 \times 16^1 + 0 \times 16^1$

$16 + 16^1 + 0$

$16^1 + 1$

$16 = 1 \times 16 + x$

$x = 0$

$16^2 \times 14 + 16^2 \times 1 + 16^2 \times 1$

$16^2 \times 16$

$(16+0) \times 16^2$

$16 \times 16^2 + 0 \times 16^2$

$16 \times 16^2 + 0$

16^2

d) $A2 + 1F$ (hexadecimal) $= C1_{16}$

$$\begin{array}{r} A2 \\ +\ 1F \\ \hline C1 \end{array}$$

$+\ 15$

$17 = 1 \cdot 16 + x$

$x = 1$

$16^0 \times 2 + 16^0 \times 15$

$16^0 \times 17$

$16^0 \times (16+1)$

$16^0 \times 16 + 16^0 \times 1$

$16^0 \times 16 + 1$

$2 \times 16^0 + 10 \times 16^1 = 162$

$15 \times 10^0 + 1 \times 16^1 = 31$

$162 + 31 = 193$

16 | 193	
16 | 12	1 Remain
0	12 Remain

C1