9.4 Week one

1.13. (a) $1010_2 = 2^1 + 2^3 = 10_{10}$

(c) $11110000_2 = 2^4 + 2^5 + 2^6 + 2^7 = 16+32+64+128 = 240_{10}$

1.15. (a) $1010_2 = 10_{10} = A_{16}$

(c) $11110000_2 = 240_{10} = F0_{16}$

1.17. (a) $A5_{16} = 5 \times 16^0 + 10 \times 16^1 = 5 + 160 = 165_{10}$

(c) $FFFF = 15 \times (16^0 + 16^1 + 16^2 + 16^3) = 65535_{10}$

1.19. (a) $A5_{16} = 165_{10} = 10100101_2$

(c) $FFFF_{16} = 65535_{10} = 1111111111111111$.

$(FFFF_{16} + 1 = 10000_{16} = 16^4 \Rightarrow FFFF_{16} = 16^4 - 1$

$= (2^4)^4 - 1 = 2^{16} - 1 = 1\,0$(16个0)$\,-1 =$ 16个1)

1.21. (a) 1010_2 (补码) $= -2^3 + 2^1 = -8 + 2 = -6_{10}$

(c) 01110000_2 (补码) $= 2^4 + 2^5 + 2^6 = 16+32+64 = 112_{10}$

1.23. (a) 1010_2 (带符号原码) 1表示负号. 则 $= -2_{10}$

01110000_2 (带符号原码) 0表示正号. 则 $= 112_{10}$.

1.33. (a) $0101_2 \to 00000101_2$

(b) $1010_2 \to 11111010_2$

(check: $1010 = -8 + 2 = -6$.

$11111010 = -128 + 64+32+16+8+2 = -6$.)

1.47. 50×10^9 bytes $= 5 \times 10^{10}$ bytes (?)

1.52. (a) $1001_2 + 0100_2 = 1101_2$ (不会 overflow)

(b) $1101_2 + 1011_2 = 11000 \xrightarrow{4位情况} 1000_2$ (overflow)

1.54. (a) $1001 + 0100 = 1101$ $(-7 + 4 = -3)$ (不会 overflow)

(b) $1101_2 + 1011_2 = 11000 \xrightarrow{4位} 1000_2$

$(-3 + (-5)) = -8$ (不会 overflow)

1.65. (a) 371_{10}.

$1_{10}: 0001_{BCD}$

$3_{10}: 0011_{BCD}$

$7_{10}: 0111_{BCD}$

$371_{10} = 0011\_0111\_0001_{BCD}$

(b) $000110000111_{BCD} = 187_{10}$

(c) $10010101_{BCD} = 95_{10} = 1011111_2$

(d) "1" 当十进制数位数增多时，BCD码占位多。

< 设一个decimal数有n位.

则BCD编码占4n位，二进制编码占k位. 其中k满足：

$10^{n-1} \le 2^k \le 10^n \Leftrightarrow (n-1)\log_2 10 \le k \le n\log_2 10$

$k \le (\log_2 10)\, n \approx 3.2n < 4n$

当n很大时：BCD编码占位极多 >

"2" 加法complex，若binary和 > $(1010)_2$，需要再加上 $(0110)_2$.

supplement:

1. 将下列余3码转换成十进制数和2421码.

(a) $0110\_1000\_0011 \xrightarrow{8421码} 0011\_0101\_0000 \xrightarrow{10进制} 350$

(余3码是8421码 +0011) $\xrightarrow{2421码} 0011\_1011\_0000$

(b) $0100\_0101.1001 \xrightarrow{8421码} 0001\_0010.0110 \xrightarrow{10进制} 12.6$

$\xrightarrow{2421码} 0001\_0010.1100$

2. 试用8421码和格雷码分别表示下列二进制数.

(a) $111110_2 = 2+2^2+2^3+2^4+2^5 = 2+4+8+16+32 = 62_{10}$

$= 0110\_0010_{8421} = 100001_{Gray}$

(b) $1100110_2 = 64+32+4+2 = 102_{10} = 0001\_0000\_0010_{8421}$

$= 1010101_{Gray}$