L5 practice problems

Answers:

1. (i) hexadecimal notation

(a) 0010 0110 (bin) = 26 (hex)

(b) 0111 1111 (bin) = 7F (hex)

(c) 1000 0001 (bin) = 81 (hex)

(d) 1111 1111 (bin) = FF (hex)

(ii) signed decimal value

(a) 0 010 0110 = 38_{10}

(b) 0 111 1111 = 127_{10}

(c) 1 000 0001 = -127_{10}

(d) 1 111 1111 = -1_{10}

2. a) 2 numbers of opposite signs being added, there is no overflow.

b) A subtraction that involves 2 numbers of opposite signs has a potential for overflow:

0 1011000 - 1 0000010	(positive minus negative)
= 0 1011000 + 0 1111110	(positive plus positive)
= 1 1010110	(result has different sign bit)

Overflow because the correct result should be positive.

c) An addition that involves 2 numbers of the same sign has a potential for overflow:

0 1111111 + 0 0000010 = 1 000 0001

Sign bit of result = 1 indicates overflow because adding two positive numbers cannot produce a negative result.

An overflow has occurred.

d) A subtraction that involves 2 numbers of the same sign has no overflow.

3. (a) E2 + 42 = 24 (hex) – ignore carry out bit
Msb of E is 1, msb of 4 is 0
Adding two numbers of opposite sign => no overflow

(b) 58 – 82 = 58 + 7E = D6 (hex)
Msb of 5 is 0, msb of 7 is 0, msb of D is 1
58 and 7E are both positive but D6 is negative => overflow

(c) 7F + 02 = 81 (hex)
Msb of 7 is 0, msb of 0 is 0, msb of 8 is 1
7F and 02 are both positive but 81 is negative => overflow

(d) E1 – FD = E1 + 03 = E4 (hex)
Msb of E is 1, msb of F is 1
Subtracting two numbers of same sign => no overflow

***Interesting observation** (easier to check with a calculator):*

Take 2's complement of 82hex:

82hex = 1000 0010 (bin), 2's comp is (1 0000 0000 minus 1000 0010)

= 0111 1110 (bin) [compare with short-cut method]

Alternatively, 2's complement of 82hex can be obtained as follows:

100hex minus 82hex = 7Ehex = 0111 1110 (bin)

You can try this out using the native calculator on a Windows PC