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CSE 401 – Dr. Gomez

Homework 3

3.8

Assume 185 and 122 are signed 8-bit decimal integers stored in sign-magnitude format. Calculate 185 - 122. Is there overflow, underflow, or neither?

The sign-magnitude representation for these two given 8-bit decimal integers are:

$(185)_{10}=(1011\ 1001)_2$

= -57

Similarly,

$(122)_{10} = (0111\ 1010)_2$

= 122

In sign-magnitude form, the result of: - A – (+B) = - (A + B)

Therefore,

185-122 = -57 – (122)

= -57 + 122

The calculation for 185 – 122 is:

0111001 (57)

+

1111010 (122)

10110011

Neglecting the 8th bit, the result is: $(011011)_2 = (51)_{10}$

The sign of the operation will be negative.

Thus, the calculation 185 – 122 = (-57) – (122) results in -51.

Since, there was a carry generated during the addition, hence, an **overflow** occurs in the operation.

3.24

Write down the binary representation of the decimal number 63.25 assuming the IEEE 754 double precision format.

Double precision uses two 32-bit words for representing a floating-point value. The numbers are 53 bit long in double precision (1 + 52).

<u>Following steps must be taken for converting 63.25 from base 10 to IEEE 754 double precision:</u>

• Convert 63 to base 2 which is $(111111)_2$

• Convert (.25) to base 2 which is $(.01)_2$

• Add both:

$(63) + (.25) = (111111) + (0.01)$

$= (1111111.01)_2$

Writing it to binary scientific notation:

$63.25 \times 10^{0} = (111111.01) * (2^{0})$

Normalize and move the binary point 5 times to the left

$(1.1111101) * (2^{5})$

This number is written in IEEE 754 Double Precision:

$(-1)^{s} * (1+\text{Fraction}) * 2^{(\text{exponent} - 1023)}$

$= (-1)^{0} * (1 + (.1111\ 1010\ 0000)) * 2^{(1028 - 1023)}$

5 is converted to the correct bias; Since the bias is 1023, we add 5 to it. Which gives us 1028. Binary form of 1028 is: 10000000100_2

The Binary Representation assuming IEEE 754 double precision is: 0 1000000100 1111 1010 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000