

22C:160/55:132 Homework 2 sample solutions

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Question 1.

$$123.4 = 1.11101101100110011001101 \times 2^6$$

Please note that the last bit is rounded to the nearest value.

$$\text{exponent field} = 127+6 = 133$$

$$\underbrace{0}_{\text{sign}} \underbrace{10000101}_{\text{exponent}} \underbrace{11101101100110011001101}_{\text{significand}}$$

$$345.6 = 1.01011001100110011001101 \times 2^8$$

$$\text{exponent field} = 127+8 = 135$$

$$\underbrace{0}_{\text{sign}} \underbrace{10000111}_{\text{exponent}} \underbrace{01011001100110011001101}_{\text{significand}}$$

$$\begin{array}{r} 0.0111101101100110011001101 \\ +) 1.01011001100110011001101 \\ \hline 1.110101010000000000000001 \end{array}$$

it is already normalized, and without overflow or underflow, so the result is

$$\underbrace{0}_{\text{sign}} \underbrace{10000111}_{\text{exponent}} \underbrace{110101010000000000000000}_{\text{significand}}$$

the value is $1.11010101 \times 2^8 = 469.0$

Question 2.

$$X(0) := X(0) + 1; Y(0) := Y(0) + X(0); X(1) := X(1) + 1$$

for($k = 0; k < 98; k = k + 1$) {

$$Z(k) := Y(k) + 2;$$

$$Y(k + 1) := Y(k + 1) + X(k + 1);$$

$$X(k + 2) := X(k + 2) + 1;$$

}

$$Z(98) := Y(98) + 2; Y(99) := Y(99) + X(99); Z(99) := Y(99) + 2$$

Software pipelining is different from loop unrolling. It shows a method of removing data dependence among the statements in the body of the loop. Unlike loop unrolling, the size of the loop does not increase.

Question 3.

The average penalty for a BTB hit is $0.2 \cdot 2 = 0.4$, The average penalty for a BTB miss is $0.5 \cdot 2 = 1$, so average penalty for each branch is $0.95 \cdot 0.4 + 0.05 \cdot 1 = 0.43$ cycle