Computer Organization HW2

1. Consider two different implementations of the same instruction set architecture. The instructions can be divided into four classes according to their CPI (classes A, B, C, and D). P1 with a clock rate of 2.5 GHz and CPIs of 1, 2, 3, and 3, and P2 with a clock rate of 3 GHz and CPIs of 2, 2, 2, and 2. Given a program with a dynamic instruction count of 1.0E6 instructions divided into classes as follows: 10% class A, 20% class B, 50% class C, and 20% class D
   a) What is the global CPI for each implementation?
   b) Find the clock cycles required in both cases.
   c) Which implementation is faster, why?

2. Assume that registers x5 and x6 hold the values 0x80000000 and 0xD0000000, respectively.
   a) What is the value of x30 for the following assembly code?

      add x30, x5, x6

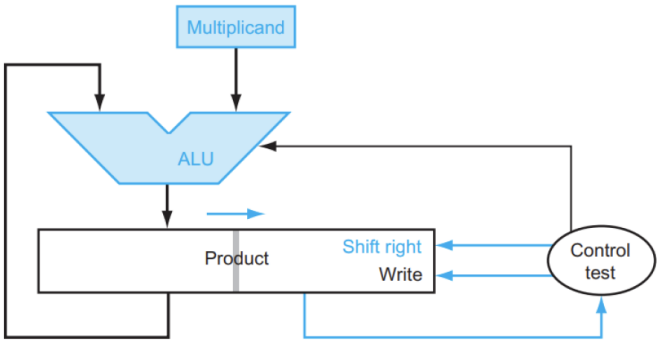
      Is the result in x30 the desired result, or has there been overflow? Explain it.
   b) For the contents of registers x5 and x6 as specified above, what is the value of x30 for the following assembly code?

      sub x30, x5, x6

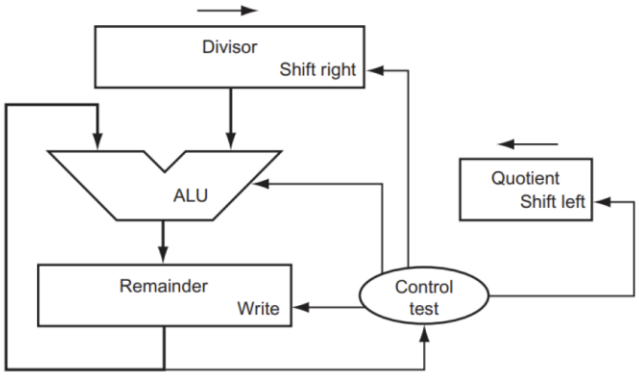
      Is the result in x30 the desired result, or has there been overflow? Explain it.

3.
   a) Assume 23 and 112 are signed 8-bit decimal integers stored in two's complement format. Calculate 23 + 112 using saturating arithmetic. The result should be written in decimal. Show the steps for calculation.
   b) Assume 23 and 112 are signed 8-bit decimal integers stored in two's complement format. Calculate 23 - 112 using saturating arithmetic. The result should be written in decimal. Show the steps for calculation.

4. Calculate the product of the hexadecimal unsigned 8-bit integers 62 and 14 using the hardware described below. You should show the binary contents of each register on each step. Use a table to show the detailed process.



5. Calculate unsigned 6-bit integer 62 divided by 21 using the hardware described below. You should show the binary contents of each register on each step. Use a table to show the detailed process.



6.

a) What decimal number does the bit pattern 0×0C000000 represent if it is an IEEE754 single precision floating point number? Show the steps for calculation.

b) Write down the binary representation of the decimal number 63.25 assuming the IEEE754 single precision format. Show the steps for calculation.