EEE225 Solutions 5 - NJP

1.a.

If performance is taken as the execution time for a certain program, then it will depend upon the number of clock cycles needed to execute the program, which depends upon the number of instructions required and the average number of clock cycles per instruction (CPI). The two computers may have a different CPI for the instruction mix used in a certain program; hence the performance can't be decided on clock speed alone.

b.

Assume that the program has I instructions:

For computer X, execution time = I x CPI x clock cycle time = (I x CPI) / clock speed

8 = (I x CPI) / 2 (Consider frequencies to be in GHz)

16 = (I x CPI)

For computer Y, execution time = (I x 1.4CPI)/F (target frequency F in GHz)

7 = (I x 1.4CPI)/F

F = (I x 1.4CPI)/7 = 0.2 x I x CPI = 0.2 x 16 = 3.2 GHz

c.

There will be practically no current flowing into the inverting input of the op-amp which is a virtual earth. Hence, the input currents flowing through the input resistors, which are proportional to the binary weightings will flow through the feedback resistor and develop an output voltage proportional to the sum of the binary input values.

Vout = - (V_2 x R/2R + V_1 x R/4R + V_0 x R/8R)

Vout = - ($0.5V_2 + 0.25V_1 + 0.125V_0$)

For input levels of 5V and a binary input of 110:

Vout = - (0.5x5 + 0.25x5) = - (2.5 + 1.25) = -3.75V

d.

For converters with higher resolutions, the tolerance of the resistors becomes a problem. For an 8-bit converter, 8 resistors in the range R to 128R would be used. This requires a tolerance of 1 part in 255 or .392%. Resistors of this tolerance would be very expensive.