Problems

1.1 You are to write an IAS program to compute the results of the following equation.

$$Y = \sum_{X=1}^{N} X$$

Assume that the computation does not result in an arithmetic overflow and that X, Y, and N are positive integers with $N \geq 1$. *Note*: The IAS did not have assembly language, only machine language.

a. Use the equation $\text{Sum}(Y) = \frac{N(N+1)}{2}$ when writing the IAS program.

b. Do it the "hard way," without using the equation from part (a).

1.2 **a.** On the IAS, what would the machine code instruction look like to load the contents of memory address 2 to the accumulator?

b. How many trips to memory does the CPU need to make to complete this instruction during the instruction cycle?

1.3 On the IAS, describe in English the process that the CPU must undertake to read a value from memory and to write a value to memory in terms of what is put into the MAR, MBR, address bus, data bus, and control bus.

1.4 Given the memory contents of the IAS computer shown below,

Address	Contents
08A	010FA210FB
08B	010FA0F08D
08C	020FA210FB

show the assembly language code for the program, starting at address 08A. Explain what this program does.

1.5 In Figure 1.6, indicate the width, in bits, of each data path (e.g., between AC and ALU).

1.6 In the IBM 360 Models 65 and 75, addresses are staggered in two separate main memory units (e.g., all even-numbered words in one unit and all odd-numbered words in another). What might be the purpose of this technique?

1.7 The relative performance of the IBM 360 Model 75 is 50 times that of the 360 Model 30, yet the instruction cycle time is only 5 times as fast. How do you account for this discrepancy?

1.8 While browsing at Billy Bob's computer store, you overhear a customer asking Billy Bob what is the fastest computer in the store that he can buy. Billy Bob replies, "You're looking at our Macintoshes. The fastest Mac we have runs at a clock speed of 1.2 GHz. If you really want the fastest machine, you should buy our 2.4-GHz Intel Pentium IV instead." Is Billy Bob correct? What would you say to help this customer?

1.9 The ENIAC, a precursor to the ISA machine, was a decimal machine, in which each register was represented by a ring of 10 vacuum tubes. At any time, only one vacuum tube was in the ON state, representing one of the 10 decimal digits. Assuming that ENIAC had the capability to have multiple vacuum tubes in the ON and OFF state simultaneously, why is this representation "wasteful" and what range of integer values could we represent using the 10 vacuum tubes?

1.10 For each of the following examples, determine whether this is an embedded system,