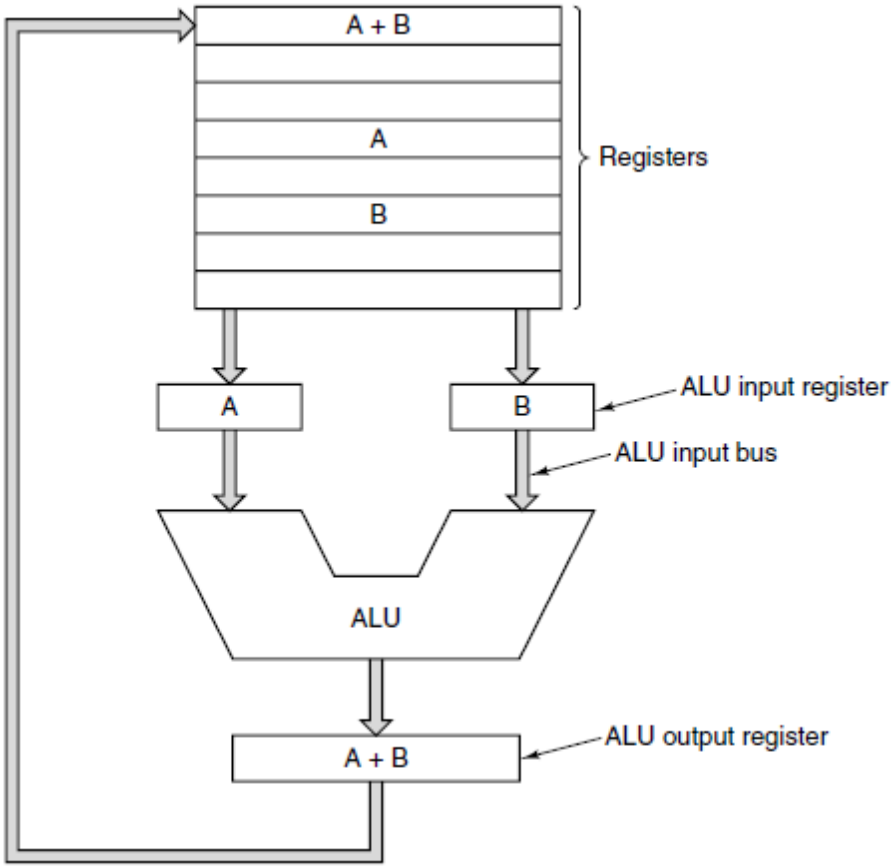
Home Work No. 1

1. The performance of machine #1 is 10 times that of machine #2, yet the cycle time of machine #1 is only 3 times faster than machine #2. How do describe this?
2. On computer #1, average instruction execution time is 4 nsec. On computer 2, it is 2 nsec. Can we say that computer 2 is two times faster than computer 1? Why? Explain.
3. Find three appliances around you that are run by an embedded CPU and describe the functionalities of the CPU in the appliance.
4. Consider a machine with the following data path:

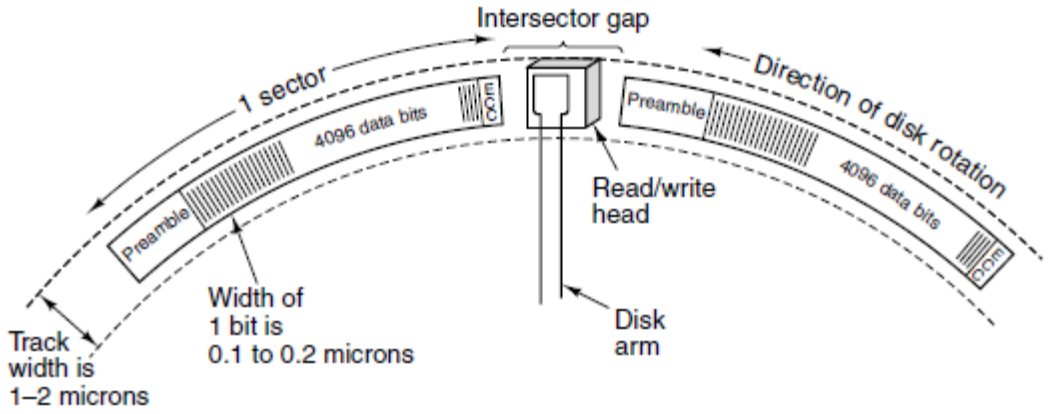


   Suppose that loading the ALU input registers takes 1 nsec, running the ALU takes 4 nsec, and storing the result back in the output register takes 1 nsec. Calculate the maximum number of MIPS this machine is capable of doing without pipelining?

5. Compute the data rate of the human eye using the following information. The visual field consists of about 106 elements (pixels). Each pixel can be reduced to a superposition of the three primary colors, each of which has 64 intensities. The time resolution is 100 msec.
6. A DNA molecule is a linear sequence of the four basic nucleotides: *A*, *C*, *G*, and *T*. The human genome contains approximately 3 × 109 nucleotides in the form of about 30,000

genes. What is the total information capacity (in bits) of the human genome? What is the maximum information capacity (in bits) of the average gene?

7. The disk illustrated below has 1024 sectors per track and a rotation rate of 7200 RPM. What is the sustained transfer rate of the disk over one track?



8. A computer has a bus with a 5-nsec cycle time, during which it can read or write a 32-bit word from memory. The computer has an Ultra4-SCSI disk that uses the bus and runs at 160 Mbytes/sec. The CPU normally fetches and executes one 32-bit instruction every 1 nsec. How much does the disk slow down the CPU?

9. A high-end digital camera has a sensor with 24 million pixels, each with 6 bytes/pixel. How many pictures can be stored on an 8-GB flash memory card if the compression factor is 5x? Assume that 1 GB means 230 bytes.