***#9.5-Solution: Before a tape controller can manage a DMA transfer, it must have five pieces of information:  
- Where the data is stored (or to be stored) in memory  
- Where the data is located (or to be located) on tape  
- How much data is to be transferred  
- Which direction, tape-to-memory or vice-versa  
- When, exactly, to initiate the transfer  
Programmed output instructions would be used to send this information to the tape controller.  
-----------------------------------------------------------------------------  
# 9.7-Solution: Polling is a technique in which a program uses programmed I/O to send out requests to I/O devices for determining the status of the device. The device returns a message word that describes the requested information. Polling is usually used for identifying I/O device events that require attention when interrupts are not available. The CPU checks each device periodically for such events. The disadvantage is the overhead required to use polling. A device must be polled frequently enough to assure that data held by the I/O device awaiting transfer is not lost. If there are a large number of devices to be polled, much of the CPU's time is wasted doing polling instead of other, more useful processing. The use of interrupts is a better way of managing I/O requests.  
---------------------------------------------------  
9.9- Solution: To initiate printing, the computer sets up a DMA transfer of one or more blocks of data from memory to the printer's buffer. The initial transfer will also provide metadata to the printer to control the type of printer output being requested. As the printer prints blocks of data, it sends interrupts to the computer, requesting additional DMA block transfers. The printer will normally do this when the buffer is running low, since the printer buffer normally holds several blocks at a time, however some printers will wait until the buffer is empty before requesting additional blocks. The printer will send an interrupt to the computer when printing is complete. This allows the computer to clear the memory buffer and to close the print driver operation. The printer must also have the capability to create interrupts that indicate printer problems. These will suspend printing and result in messages to the user to fix the problem. The printer holds the current print block in its buffer, with a pointer to the location where printing was suspended.  
----------------------------------------------------------------------  
9.12- Solution: In general, an interrupt serves to allow external access to the CPU to notify the CPU of external events that require attention or action by the CPU. Without interrupts, the CPU would be required to take an active and continuous role in searching for external events, or risk losing information that might be important to the system. Polling would have to be used for this purpose. The cost of polling is CPU overhead, since each polling action requires the use of an output instruction followed by an input instruction. The additional CPU burden can be severe under some conditions, for example when the number of polled devices is large and the polling must be done frequently. The overall effect is a reduction in system performance.  
--------------------------------------------------------------  
Chapter 9 Calculation Exercise ”If my CPU runs at 4.0GHz, and on average takes 10 clock cycles to complete an instruction, how many instructions will be completed in the time it takes to type "MY CPU IS RUNNING NOW"? Assume it takes 5 seconds to type the message. Show your work and how you arrived at the solution”.  
  
Sol: 4.0 G (cycles/sec) (1 instruction/10 cycles) (5 seconds) = 2,000,000,000 instructions***