ECE 375 PRELAB 6

Lab Time: Friday 2-4

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QUESTIONS

1. In computing, there are traditionally two ways for a microprocessor to listen to other devices and communicate: polling and interrupts. Give a concise overview/description of each method, and give a few examples of situations where you would want to choose one method over the other.

   With polling, the program constantly checks for an external event. For example, this method can be used to check whether a switch is triggered or not. An interrupt signals of an unexpected event (overflow, divide by 0, undefined opcode, ect.) that causes a change in a normal program flow. This allows the processor to suspend the program when an external event occurs and then resumes to the program after servicing the interrupt.

2. Describe the function of each bit in the following ATmega128 I/O registers: EICRA, EICRB, and EIMSK. Do not just give a brief summary of these registers; give specific details for each bit of each register, such as its possible values and what function or setting results from each of those values. Also, do not just directly paste your answer from the datasheet, but instead try to describe these details in your own words.

   EICRA: controls how interrupts are sensed for INT3-0. This is used to determine when an interrupt is triggered based on its value. For example, 00 means low level, 11 means falling edge, and 01 means rising edge.

   EICRB: controls how interrupts are sensed for INT7-4. This is used to determine when an interrupt is triggered based on its value. For example, 00 means low level, 11 means falling edge, and 01 means rising edge.

   EIMSK: External Interrupt Mask Register which allows each interrupt to be detected or ignored.

3. The ATmega128 microcontroller uses interrupt vectors to execute particular instructions when an interrupt occurs. What is an interrupt vector? List the interrupt vector (address) for each of the following ATmega128 interrupts: Timer/Counter0 Overflow, External Interrupt 5, and Analog Comparator.

   An interrupt vector is a memory location dedicated for an interrupt. The first 70 ($46) locations in program memory are dedicated for interrupts. Interrupt vector for Timer/Counter0 Overflow is at $0020, Interrupt vector for External Interrupt 5 is at $000C, Interrupt vector for Analog Comparator is at $002E.

4. Microcontrollers often provide several different ways of configuring interrupt triggering, such as level detection and edge detection. Suppose the signal shown in Figure 1 was connected to a microcontroller pin that was configured as an input and had the ability to trigger an interrupt based on certain signal conditions. List the cycles (or range of cycles) for which an external interrupt would be triggered if that pin's sense control was configured for: (a) rising edge detection, (b) falling edge detection, (c) low level detection, and (d) high level detection. Note: There should be no overlap in your answers, i.e., only one type of interrupt condition can be detected during a given cycle.

   a) Rising edge detection: cycles 6 and 18
   b) Falling edge detection: cycles 3 and 9
   c) Low level detection: cycles 4-5 and 10-17

d) High level detection: cycles 1-2, 7-8, 19-21

REFERENCE

[Computer Organization and Assembly Language Programming: Embedded Systems Perspective](#)