

ECE 375 Prelab 5

Lab Time: Friday 2 PM - 3:50 PM

Winnie Woo

TA Signature

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.

Polling is when it loops and checks the I/O value of each cycle, which is more restricting because the microprocessor is confined to check the entire loop until the program can be resumed.

Interrupts signals the computer when unexpected timing occurs which allows the computer to pause the program and service the external (hardware-based) event and then resume the program. Interrupts can be more efficient because the microprocessor is not restricted.

2. Describe the function of each bit in the following ATmega32U4 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 INT3 - INT0 are detected Bits 0,1 are trigger state for interrupt 0

Bits 2,3 - INT1

Bits 4,5 - INT2

Bits 6,7 - INT3

EICRB: controls how INT7-INT4 are detected 00 - sets interrupt to be triggered on LOW

01 - sets interrupt to be triggered when state changes

10 - sets interrupt to be triggered on falling edge

11 - sets interrupt to be triggered on rising edge

EIMSK: allows each interrupt to be either detected or ignored Bit 0 - enables INT0

Bit 1 - enables INT1

Bit 2 - enables INT2

Bit 4 - enables INT3

Bit 6 - enables INT6

3. The ATmega32U4 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 ATmega32U4 interrupts: Timer/Counter0 Overflow, External Interrupt 6, and Analog Comparator.

An interrupt vector is an address that will be automatically jumped to if it is detected by the microcontroller.

Timer/Counter0 Overflow: 0x0030

External Interrupt 6: 0x000E

Analog Comparator: 0x0038

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; Interrupt would trigger at 7, 14

B: Interrupt would trigger at 2, 11

C: Interrupt would trigger at 3, 12

D: Interrupt would trigger at 1, 8, 15