Drak Vidkjer
ECE 375
Lab 06 Pre-Lab

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*

An interrupt is an event that stops the normal execution flow of instructions. It is caused by either an external or internal source such as a hardware pin or a clock/timer. Interrupts are like abrupt changes. An example would be if you were cooking, and preparing vegetables but then took something out of the oven because you heard the timer go off and then went back to preparing vegetables. Poling works by periodically checking an external or internal device or pin for a change and then doing something when the status of that device/pin changes. An example of this could be constantly checking the oven to see if something is done and then taking it out when it is. Polling would be preferable for something that happens multiple times, or that is going to happen regularly. Interrupts would be preferred for something that will happen fewer times, but things that need to be done right away. On a car, polling would be prefered for reacting to changes in speed, where interrupts would be good for reacting to say loss of traction, or needing the airbags to deploy.

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: External Interrupt Control Register A. 8 bit register that configures registers 0-3. Each register is divided into four nibbles, each one configuring a single interrupt. Each nibble has four states that indicate what type of signal generates an interrupt. If nibble has value of 0b00 then a low level signal will generate an interrupt. 0b01 indicates a falling edge interrupt.

EICRB: Similar to EICRA except for the scheme of interrupt signals. Ob00 has same effect. 0b01 indicates an interrupt for any logical change, 0b10 indicates a falling edge interrupt, and 0b11 indicates a rising edge interrupt.

EIMSK: External Interrupt Mask Register. 8 bit register that determines which interrupts are enabled. Each bit turns on / off a respective interrupt.

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 the location in memory of an interrupt handler. An interrupt is an external or internal signal from a device/program that tells the main program to stop current execution and run a subroutine based on the origin of that interrupt.
    Timer/Counter0: $0011
    External Interrupt 5: $0012
    Analog Comparator: $002F

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.*

    Rising Edge: 6-7, 17-18
    Falling Edge: 3-4, 9-10
    Low Level: 4-6, 10-18
    High Level: 1-3, 7-9, 18-21