ECE 375 Prelab 8

Lab Time: Wednesday 5-7

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TA Signature

1 Questions

1. In this lab, you will be given a set of behaviors/actions that you need to have a proof-of-concept "toy" perform. Think of a toy you know of (or look around online for a toy) that is likely implemented using a microcontroller, and describe the behaviors it performs. Here is an example behavior: "If you press button X on the toy, it takes action Y (or makes sound Z)".

   A good example would be a baby's light up rattle. This toy would be movement-activated – when the ball in the middle of the rattle hits the sides of the globe it is encased it, it lights up and/or makes a noise. Moreover, if you press the on switch at the base of the toy, the toy may light up and make noise indicated it is on.

2. For each behavior you described in the previous question, explain which microcontroller feature was likely used to implement that behavior, and give a brief code example indicating how that feature should be configured. Make your explanation as ATmega128-specific as possible (e.g., discuss which I/O registers would need to be configured, and if any interrupts will be used), and also mention if any additional mechanical and/or electronic devices are needed.

   The ball at the middle of the toy may use multiple switches that are depressed each time they hit the walls of the globe. This would be detected on a high signal which triggers light and sound from the LEDs (in this case as PORTB is triggered, PORTD and a sound PORT is outputted). In order to possibly make consistency within the lates flashing, timers were used to provide delay between each LED flash.

3. Each ATmega128 USART module has two flags used to indicate its current transmitter state: the Data Register Empty (UDRE) flag and Transmit Complete (TXC) flag. What is the difference between these two flags, and which one always gets set first as the transmitter runs? You will probably need to read about the Data Transmission process in the datasheet (including looking at any relevant USART diagrams) to answer this question.

   When a byte is transferred into the TC register, UDRE is set. UDRE indicates that the UDR does not have any data and that it cannot be transferred to UDR. TXC is used to detect when the last transmit bit has left to switch to receive mode. Moreover, UDRE has a 2 byte buffer, while TXC is set only after the last byte has been shifted out.

4. Each ATmega128 USART module has one flag used to indicate its current receiver state (not including the error flags). For USART1 specifically, what is the name of this flag, and what is the interrupt vector address for the interrupt associated with this flag? This time, you will probably need to read about Data Reception in the datasheet to answer this question.

   The name of this flag is the RXEN, or the reciever enable flag, within the UCSRB register. It's corresponding interrupt vector is $003C.