CG2271 Real-Time Operating Systems

Tutorial 2

1. Which modules generate the IRQ0, IRQ10 and IRQ31 interrupt requests, and what are their CMSIS typedef enumeration labels? Examine the Interrupt Vector Assignments table in the KL25Z subfamily reference manual and the MKL25Z4.h file (or appropriate *device*.h file for a different MCU device).

2. This question involves configuring registers so that if interrupts IRQ0, IRQ10 and IRQ31 are requested simultaneously, the CPU responds as requested. For each question, explain what values must be loaded into which registers, and then write C code which uses the CMSIS functions to perform that operation.

   a. Interrupts are serviced in order IRQ10, IRQ0, IRQ31.
   b. We wish to enable IRQ13 but disable IRQ24. What value needs to be loaded into which register bits, and what is the CMSIS code call to accomplish the same?

3. Consider a system built on a 48 MHz KL25Z with a main loop and an interrupt which occurs at a 10 kHz frequency. Assume the ISR take 14.9 us to execute and there is a total of 1 us of response and return time overhead.

a. What percentage of the processor's time is spent servicing the Interrupts including the overheads?
b. What percentage of the processor's time is left for the main loop to execute?
c. If the main loop requires 37 ms of computation to execute one iteration, what is the minimum main loop update rate (in Hz)?

4. Consider the system above again, but now with the interrupt running at 25 kHz and the ISR taking 34 us to execute with 1 us of overheads.

a. What percentage of the processor's time is spent in interrupt response and return overhead?
b. What percentage of the processor's time is left for the main loop to execute?
c. If the main loop requires 37 ms of computation to execute one iteration, what is the minimum main loop update rate (in Hz)?