

Typical Questions for Experiment 4

Checkpoint 1

- What does the `bic` instruction do? How is it different from `and`?
- What does the instruction “`ldr r1,=portA`” do? What is the real instruction used?
- How long, on average, does it take the ARM processor to execute one instruction?
- What would be the frequency of the flashing LEDs if you added the `nop` instruction to the loop in Figure 3?
- Would it make any difference *where* that `nop` instruction was added?

Checkpoint 2

- What is the stack pointer initialised to? Why is this necessary in the first place?
- What is the difference between `flash-v2.s` and `flash-v3.s`? Which is better, and why?
- Where is the stack located in memory? How many bytes are reserved for the stack?
- What value of `waitval` will give you a frequency of 1 Hz for the flashing LEDs?
- What would be the frequency of the LEDs if you set `waitval` to zero?

Checkpoint 3

- What is the address of the free-running timer? What is its period (ie, time it takes to count a complete cycle, from zero to zero)?
- From your answer to Checkpoint 1, how many instructions are executed by the ARM processor during one timer tick (ie, the time it takes the timer to increment the value by one)?
- What is the implication of this when checking whether the timer has reached zero?

Checkpoint 4

- How many timer pulses add up to one second? Is the free-running timer able to count this high?
- How frequently does the timer port value *change*? How can you use this to write the delay function?

Checkpoint 5

- How many states do you need to keep track of all of the traffic light combinations?
- Where have you stored the LED settings for each state?
- How can you generate a delay of either one second or 2½ seconds using the *same* function?
- What does the requirement “Conform to the ATPCS” mean? How have you met it?

Checkpoint 6

- What are the parameters that are passed to the `lcd_if` function and what do they mean?
- What is the purpose of the function `lcd_read`?
- What is the purpose of the function `lcd_write`?
- Why is function `lcd_read` called before the function `lcd_write`?
- What command do you use to cause the cursor to move forward?
- How many hexadecimal digits are required to represent numbers in the range 0 - 9,999?
- How many do you make sure that you do not over run the LCD module?

Checkpoint 7

- How do you compare the efficiency of BCD versus the normal binary representation?

Checkpoint 8

- How do you set the direction of the SA_L pins to output?
- What is the default direction for the SA terminal pins? Which is the preferred direction (input or output)?

Checkpoint 9

- How do you set the direction of the SA_H pins to input?

Checkpoint 10

- What is the value of C ?
- What is the minimum value of the tone frequency?
- What are the values of N for frequencies 1 and 2 KHz?

Checkpoint 11

- What did you do to toggle between the two tones?
- What would you do to cycle through more than two tones?

Checkpoint 11 (No Credit)

- Is there a particular instruction that you wished that was included in the ARM's instruction set?

Checkpoint 12 (No Credit)

- Starting a scale at 1 KHz frequency what would be the frequencies for eight musical tones?

Checkpoint 13 (Extra Credit × 5)

- Can you think of a way to create DTMF tones?