Homework 3

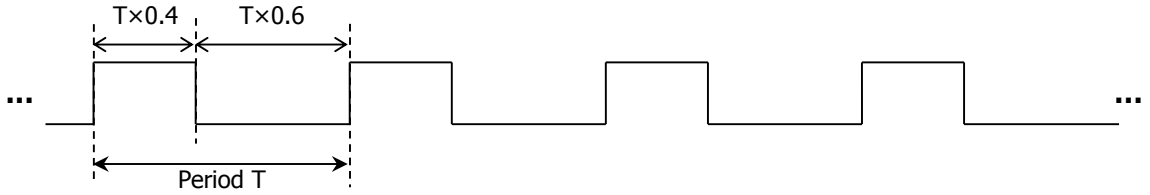
(Due date: November 6th @ 5:30 pm)
Presentation and clarity are very important! Show your procedure!

PROBLEM 1 (25 PTS)

- Using the HCS12D Timer, write a C program (*provide a printout*) that measures the period (in cycles) of a square waveform on `PT2`. Use a pre-scale factor of 4 with E-clock = 24 MHz. Note that the period of the signal can be longer than 2^{16} cycles.
  - ✓ What is the period (in units of time) of the Timer Clock?
  - ✓ What is the smallest period (in units of time) that we can measure?

PROBLEM 2 (25 PTS)

- Using the HCS12D Timer, write a C program (*provide a printout*) that generates an active high 2-kHz digital waveform with a 40% duty cycle on `PT5`. Use a pre-scale factor of 2 with E-clock = 24 Mhz. Try it by playing it on the Buzzer.



  - ✓ What is the period (in units of time) of the Timer Clock?
  - ✓ How many Timer cycles are in one period of the 2-KHz digital waveform?
  - ✓ How many Timer cycles are required for the high level portion of the period and for the low level portion of the period?

PROBLEM 3 (20 PTS)

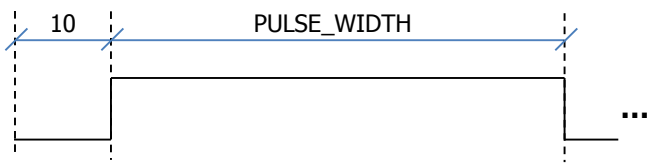
- If we want to measure the period of a signal using just one iteration of the count, i.e., within a 2^{16} cycles time window, the period has to be lower or equal than 2^{15} cycles. Assuming an E-clock of 24 MHz, what is the minimum frequency that we can measure for each of the following pre-scale factors: 1, 2, 4, 8, 16, 32, 64, and 128?

- To create a delay using the Output Compare Channel 6, we add a number of cycles (DCYCLES) to `TC6` and then wait until `TCNT` is equal to `TC6`. This happens when `TLFG1(6)=1`. Assuming an E-clock of 24 MHz:
  - ✓ Complete the following table in order to generate the given delays:

DCYCLES	Pre-scale Factor	Delay
		1 us
		100 us
		500 us
		2 ms
		80 ms
		300 ms

  - ✓ What is the largest delay (in units of time) that we can generate with Output Compare Channel 6? Provide DCYCLES and the Pre-scale Factor as well.

- To create a single pulse on `PT6`, we set the OC6 pin action to toggle when a comparison is successful. Then:
  1. We start with `PT6=0`, and wait some cycles (say 10) before we toggle to `PT6=1`: `TC6=TC6+10` and then check whether `TFLG1(6)=1`.
  2. With `PT6=1`, we wait a number of cycles before we toggle to `PT6=0`: `TC6=TC6 + PULSE_WIDTH` and then check whether `TFLG1(6)=1`.



  - ✓ Provide a PULSE_WIDTH value and a pre-scale factor in order to generate a pulse of 5 us. Assume an E-clock of 24 MHz.

PROBLEM 4 (30 PTS)

- Attach a printout of your Initial Project Report (no more than a page). This report should contain the project title, the project description, and the current status of the project. Use the provided template (`Final Project – Report Template.docx`).