

Name: _____

SIGN IMMEDIATELY, PLEASE PRINT CLEARLY

ECE RTOS Exam No. 3 (50pts.) – 15% of the final grade

General Remarks

This exam is closed books, open limited notes. Up to ¼-inch-thick office-clip-bonded paper-based notes are allowed. Notes must be signed and must not be exchanged during the exam and may be collected with the exam. No computer, pads or cell phones. Calculators approved for standardized tests are allowed. Clearly indicate questions that you continue answering on the back. Provide concise answer and to the point for maximum credit. Answers that are too long take too much time and may indicate that the author is unable to rank the importance of facts.

DL: _ ERR: _ PTS: _ MPTS: _ MGR: _

DL – exam difficulty level (adjustment), ERR – exam errors, PTS – exam points, MPTS – total midterm points, MGR – total midterm grade.

Question 1 - all questions on this page

Assume the SYSCLK runs at **24MHz** and an **8-bit** timer/counter **counts up** using **SYSCLK/3**. It triggers an interrupt at each **overflow** and at the same time **reloads the counter value from RCAP register**.

You must show your work by writing down a formula(s) that you used to compute the answer to get credit.

Question 1A (5pts.)

What is the minimum interrupt rate that can be programmed? What is RCAP value?

Minimum interrupt rate is _____ Hz (5pts) // show your work

Question 1B (10pts.)

We want to set up an interrupt running as close to **50 kHz** as possible.

What is RCAP value? What is the actual interrupt rate for that RCAP value?

The RCAP register value is _____ (5pts) // show your work

Actual interrupt rate is _____ Hz (5pts) // show your work above

Question 1C (5pts.)

The RCAP value is **176**. What is the actual interrupt rate for that RCAP value?

Actual interrupt rate is _____ Hz (5pts) // show your work

Question 1D (5pts.)

We want to set up an interrupt running as close to **12 kHz** as possible. Which pre-divider should be used?

Circle: SYSCLK/3 SYSCLK/6 SYSCLK/9 SYSCLK/10 SYSCLK/12

Question 2 - all questions on this page

We want to run a **PWM signal of 1kHz frequency** that can be controlled at the **resolution of 2%** (0-100%). You must show your work by writing down a formula(s) that you used to compute the answer to get credit.

Question 2A (5pts.)

What is the minimum interrupt frequency to allow for generating the PWM of parameters as above?

F_{interrupt,min} = _____ **Hz** // show your work

Question 2B (5pts.)

We decided to implement the PWM generator above using a **non-optimal timer interrupt running at 200kHz** and the software counter **that counts down by 1** each time the interrupt is run starting from a predefined value. What is that value? What data type should be used?

Reload value = _____ . // show your work

Question 2C (15pts.)

We decided to implement the PWM generator above using a **non-optimal timer interrupt running at 200kHz** and the software counter **that counts up by a fixed number until it rolls over at 65536**.

What is the increment value?

Increment value = _____ . // show your work

What are the actual PWM frequency and PWM resolution for that number?

Actual F_{PWM} = _____ **Hz** @ increment value // show your work

Resolution = _____ % @ increment value