Homework #5
CSCE 4114/5114
Due: November 6th, 2024

Problem #1 (25 pts)
Short answer and True/False. Provide a concise answer for the short answers, and circle T or F for each true false question. Any T / F left not circled will be counted as wrong.

1. (3pts) FreeRTOS uses the configTICK_RATE_HZ variable to set the "time slice" for the timer interrupt.

2. (3pts) FreeRTOS defines the xTaskCreate() function used to create an instance of a task.

3. (3pts)) FreeRTOS defines the vTaskStartScheduler() function to start the scheduler.

4. (3pts) FreeRTOS defines the vTaskDelay() function to specify the number of tick cycles a task should stay in the blocked state.

5. (3pts) FreeRTOS defines the vTaskDelayUntil() function to specify the exact tick count value at which the calling task should be moved from the Blocked state into the Ready state

6. (2pts) T / F FreeRTOS specifies time in terms of tick periods.

7. (2pts) T / F All tasks in FreeRTOS must return.

8. (2pts) T / F For single processor systems a $\mu \leq 1$ guarantees a schedule can be found for the tasks.

9. (2pts) T / F The rate monotonic scheduling algorithm uses time slicing to choose which task is next for execution.

10. (2pts) T / F The rate monotonic scheduling algorithm is an example of a fixed priority preemptive scheduling approach.

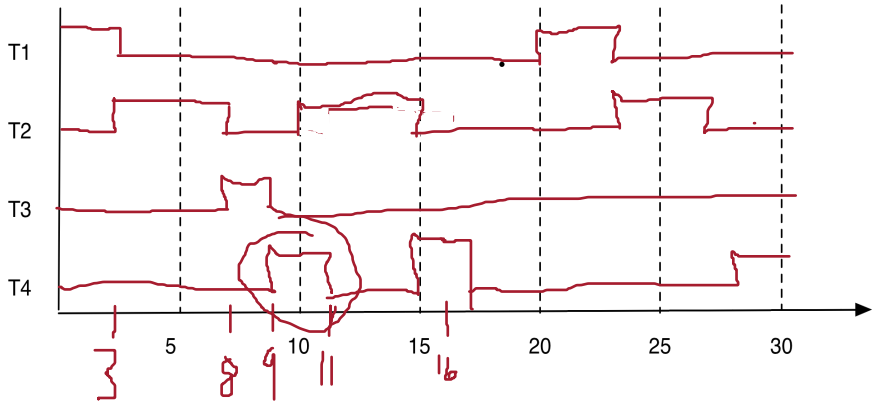
Problem #1 (75 pts)
You are trying to develop a real time system that must meet stringent timing requirements. You have mapped out the following threads, deadlines and worst case execution times.

Thread Number	W.C.E.T	Period
T1	3	20
T2	5	10
T3	1	30
T4	2	10

a) (15 pts) Apply the CPU utilization schedulability test discussed in class to determine if this setup *cannot* be scheduled under EDF.

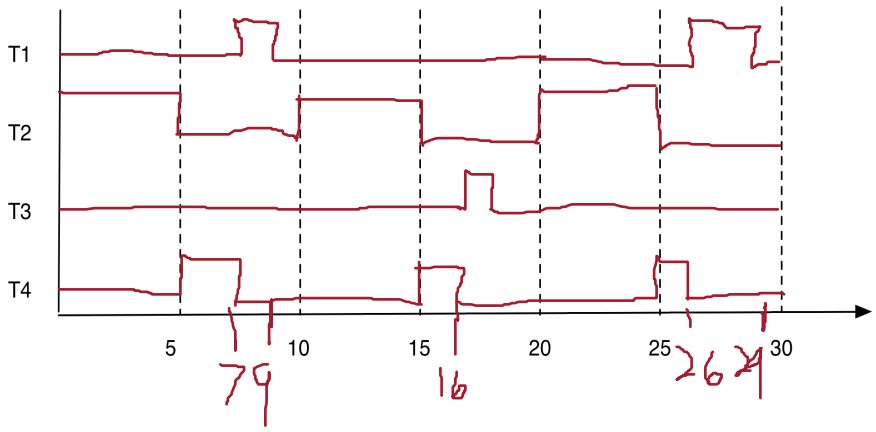
(3/20) +(5/10) + (1/30) + (2/10) = 0.8838
Since U = 0.8838 < 1 then this can be scheduled under EDF

b) (20 pts) Show how the tasks listed would be scheduled above using a pure priority based non preemptive scheduling approach, with T1 being the highest priority and T4 being the lowest. Were you able to meet all timing requirements?



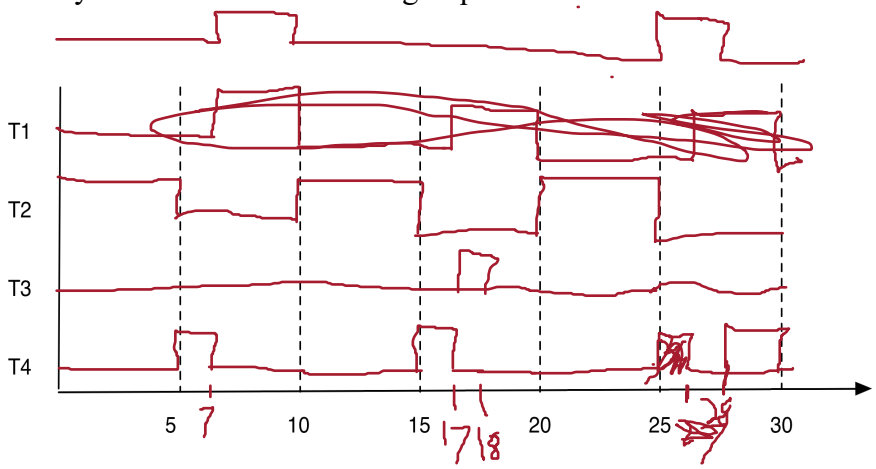
T4 is unable to finish within the given time period, so not all timing requirements were met

c) (20 pts) Show how the tasks would be scheduled using EDF. Did they meet all timing requirements ?



Yes, All timing requirements were met

d) (20 pts) Show how the tasks would be scheduled using the Rate Monotonic algorithm. Were you able to meet all timing requirements?



Yes you are able to schedule out to 30 time units however
the CPU utilization (0.883) is not less than 0.756 (Constraint with 4 tasks)
Leading to the assumption as well that this will become unscheduable at some point