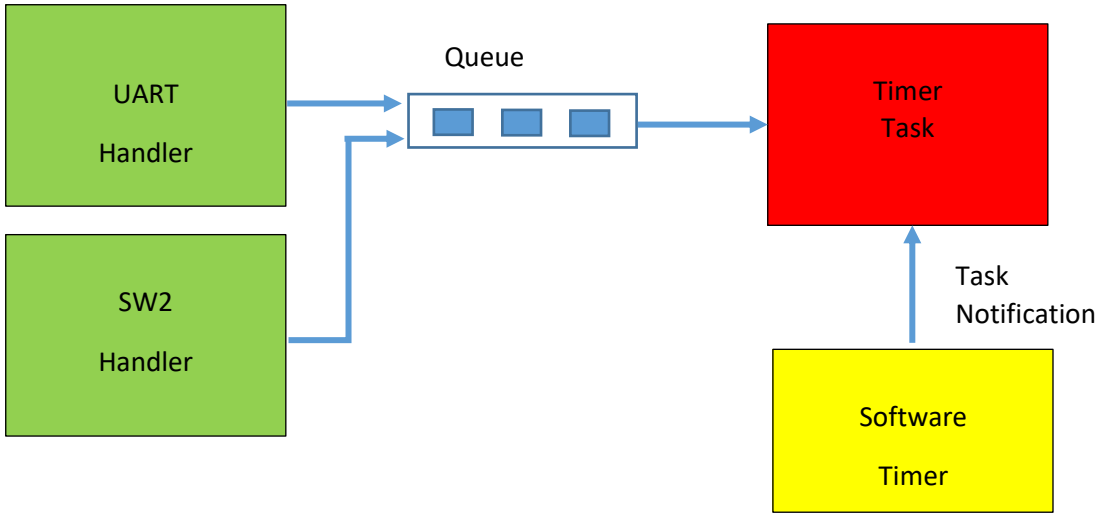
Write a C program to implement a countdown timer. The timer counts down from a start time in one second time periods. On reaching a warning time, the red LED will toggle every second until the timer stops when reaching 0 seconds. The start time and warning time will default to 20 and 10 seconds if SW2 is pressed. Alternatively, the start and warning times may be entered into the serial terminal. The one second time base for the system is provided by a task notification received from a software timer. The timer only starts counting down on receiving data from the queue.



Your embedded system should contain the following elements: -

SW2 Interrupt Handler

SW2 is connected to PTC6. The interrupt handler will run when the switch is pressed and is used to start the timer running with the default start and warning times. The handler will send an array containing 2 integers to the queue using queue by copy. The first integer in the array is the start time of 20. The second integer is the warning time of 10.

UART Interrupt Handler

The UART handler is used to allow the user to enter different start and warning times via the serial terminal. The user enters a 2-digit start time followed by return into the terminal command line. The user then enters a 2-digit warning time followed by return. The 2 numbers are then copied into an array and sent to the queue. The same queue is used for both interrupt handlers. The UART handler sends the array to the queue without any error checking.

Timer Task

The timer task is responsible for implementing the countdown timer and giving user feedback via the serial terminal. The countdown timer is only started on receiving data from the queue. This data is an array containing the start time and warning time. The task should error check the data received from the queue to check if the start time is above 60 seconds or if the warning time is greater than the start time. The task receives a task notification which provides the one second time base.

Software Timer

Once started, this timer will send a task notification to the timer task every second.

Expected serial terminal output is shown overleaf.

```
Starting Timer Task
Press SW2 for a default countdown of 20 seconds and a warning time of 10 seconds
Or enter start time and warning time on serial terminal.


Starting 20 second timer with a warning time of 10 seconds
Time: 20
Time: 19
Time: 18
Time: 17
Time: 16
```

```
Time: 03
Time: 02
Time: 01
Time: 00
Timer Stopped

Press SW2 for a default countdown of 20 seconds and a warning time of 10 seconds
Or enter start time and warning time on serial terminal.
```

```
Press SW2 for a default countdown of 20 seconds and a warning time of 10 seconds
Or enter start time and warning time on serial terminal.


Start Time: 65, Warning Time: 20
*** Invalid Timer Values Entered ***

Start Time: 10, Warning Time: 15
*** Invalid Timer Values Entered ***
```

Marking Scheme

SW2 Handler	15%
UART Handler	25%
Timer Task	40%
Software Timer/Task Notification	20%