Seminar 1 Problem Sheet

During week 1 the lecture focussed on some basic concepts. These questions are designed to check out your understanding of some of these concepts. You may need to have undertaken reading to supplement the lecture material

1. What do does the term deadline mean? Explain the difference between
    a. Hard Deadlines
    b. Soft Deadlines
    c. Absolute Deadlines
    d. Relative Deadlines
2. Real-time embedded systems are typically composed of three classes of process. Describe each of these classes.
3. When we define a scheduling scheme for real-time embedded systems what are the key factors of interest
4. Describe the simple process model that is used in the initial parts of the course. Which aspects of the model do you consider to be idealised and unrealistic?
5. Describe the characteristics of real-time systems that determine the essential features of scheduling algorithms that are used for real-time systems. In particular explain how the characteristics influence the choice of algorithm.
6. Within operating systems, which may be regarded as a class of real-time systems, the notion of priority is used to indicate the relative importance of processes. Why is this not so in hard real-time systems?
7. A data logging / signal monitor systems is made up of a set of concurrent processes. Can you identify possible *periodic* processes and *aperiodic* processes that might occur in such a system? Do you feel that such a system would have any *sporadic* processes?
8. The Weighted Round Robin (WRR) approach to scheduling is a variation of the traditional Round Robin (RR) algorithm. In RR processes are kept in a FIFO ready queue. When a process reaches the head of the queue it is given the CPU for a fixed time slot. The time slots are the same for all processes. At the end of the time slot, assuming the process has not finished, it is pre-empted and placed at the end of the ready queue. If a process completes or has nothing to do it immediately relinquishes the CPU and the next process starts it slot. In WRR some processes are allowed to hold the CPU for a larger time slice.
    a. Draw a time line to show how WRR would work for the following 3 processes:

Name	**CPU**	**Size of Slot**
A	6	2 units
B	2	1 unit
C	4	1 unit

9. This question introduces the concept of a ***Cyclic Scheduler***. (Also called Clock Driven Scheduling).

   Scheduling decisions are made at specific time instances. These instances are chosen a priori before the system begins its execution. The details of the schedule are held in a table.
   Suppose we have three processes:

Name	**Period**	**CPU requirement**
A	2	1
B	4	1
C	8	1

   The schedule we might draw up could look as follows:

A	***B***	***A***	***C***	***A***	***B***	***A***	
0	1	2	3	4	5	6	7

   In order to implement a cyclic scheduler we need to define a *frame* (a constant time slot) and define a *major cycle*. The frame must be such that each process can start and complete in a frame. This means a process will not be pre-empted. There should not be too many empty frames. The frame size should divide the major cycle. The major cycle is the least common multiple of all the periods.

   a. Produce a schedule for the following set of processes:

Name	**Period**	**CPU**
a	25	10
b	25	8
c	50	5
d	50	4
e	100	2

   b. What do you feel the disadvantages of this type of scheduling are?

10. Investigate the support provided by Micro-C for scheduling.