Selected solutions for

TDDD07
Real-time Systems

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Cyclic scheduling

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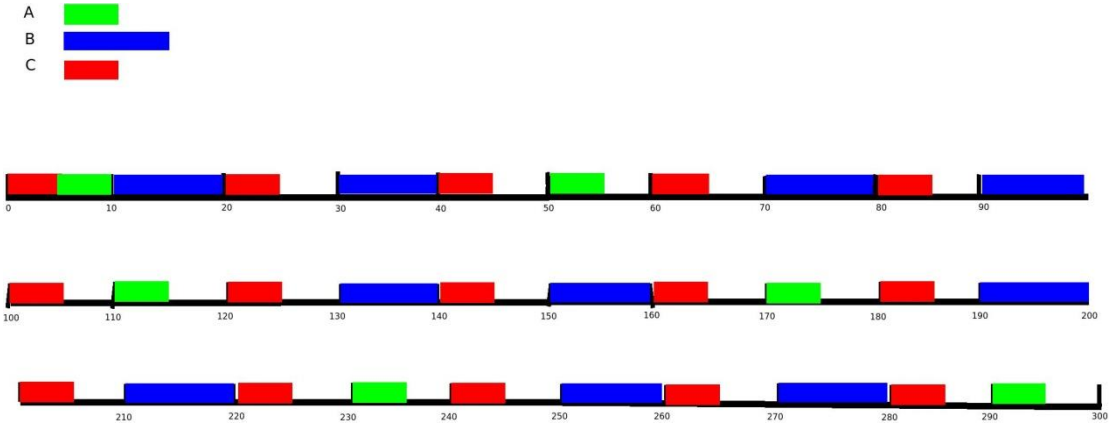
Suggested Solutions

1. Scheduling

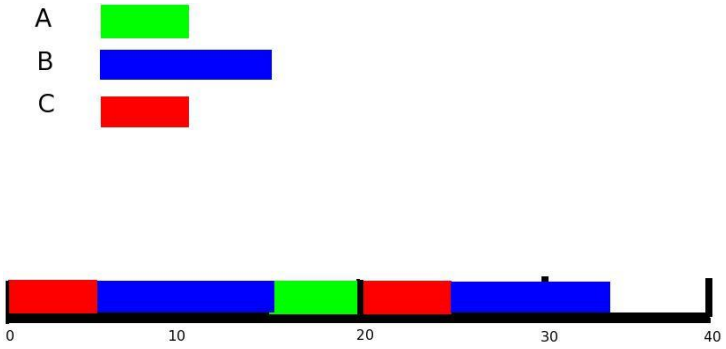
Q1.1:
The task set is schedulable using cyclic scheduling, but the tasks suffer jitter.
Here is an example of scheduling, in which you can see that tasks are affected by jitter
Major cycle: lcm(50,30,20) = 300ms
Minor cycle: gcd(50,30,20)=10ms



You can try to change the order of execution of the tasks, but the jitter still remains. One of the possible ways to schedule this task set without jitter is by reducing the periods, thus executing tasks more frequently than required (see Example (3.2), i.e. Alternative 2 in the slides of Lecture 2).

Task	*New Period (ms)*
A	40
B	20
C	20

Major cycle: lcm(40,20,20) = 40ms
Minor cycle: gcd(40,20,20)=20ms



Q1.2:

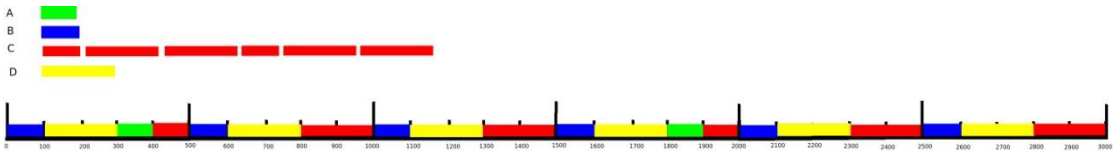
a)

Task	*Period*	*WCET*
A (Trajectory follower)	1500	100
B (Sensor & measurement)	500	100
C (Disk storage)	3000	1000
D (Ground communication)	500	200

Major cycle: lcm(1500,500,3000,500) = 3000ms
Minor cycle: gcd(1500,500,3000,500)=500ms

The task set is not schedulable. This is due to the disk storage task, that cannot be fitted in any place inside the major cycle. The task set becomes schedulable if we assume that the disk storage task can be divided into 6 processes as following:

C1=100ms,C2=200ms,C3=200ms,C4=100ms,C5=200ms, C6=200ms.

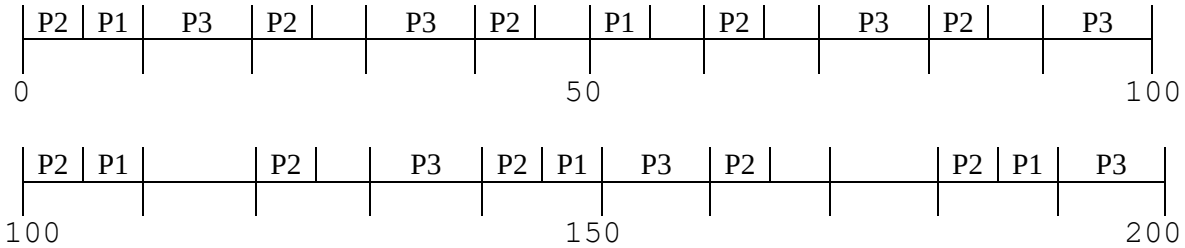


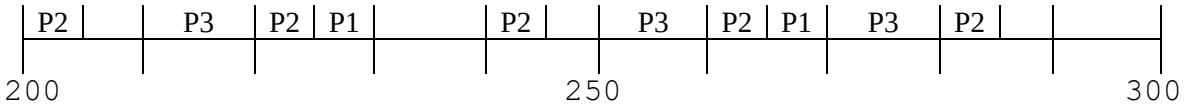
Q1.3:

1) According to the description we have the following task set:

Process	Period	WCET
P1 – Stabiliser	50ms	5ms
P2 – Star follower	20ms	5ms
P3 – Energy manager	30ms	10ms

Minor cycle: gcd (50, 20, 30) = 10ms
Major cycle: lcm (50, 20, 30) = 300 ms





Note: To guarantee that P1 provides an output every 50ms maximum, an extra execution of P1 needs to be added.