GX2546

OLLSCOIL NA hÉIREANN
THE NATIONAL UNIVERSITY OF IRELAND, GALWAY

SEMESTER II EXAMINATIONS 2000/1

CT867

Embedded System Software

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Time Allowed: **Two Hours**

Answer question 1 and 2 others

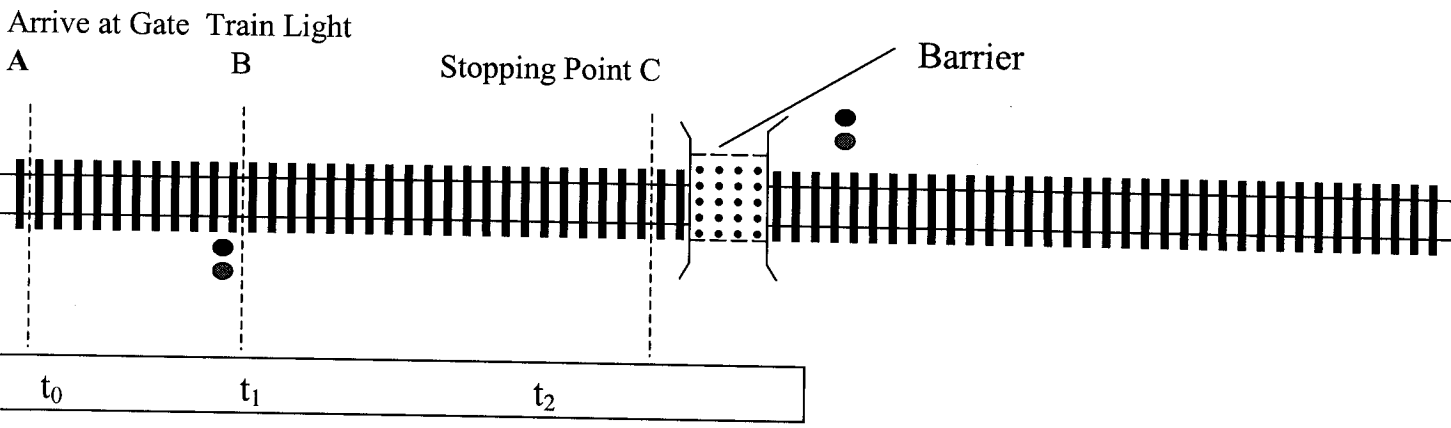
1. How are real-time processes scheduled? What is the difference between a hard and a soft real-time application? How would you determine that you have the correct scheduling algorithm for your application?

   A Real-Time Computer has to schedule 8 tasks that have three priority levels (1-3). Priority level 1 is the highest and *must* be scheduled by its dead-line. Level 2 *should* be scheduled by its dead-line and level 3 is a non real-time task with no specific deadlines but they must not be starved of resources by the real-time tasks. The table shows the arrival time, priority level, execution time and dead-line for these tasks. Describe a scheduling algorithm which will ensure that the maximum number of tasks get executed within their timing constraints.

Process	Arrival Time	Execution Time	Deadline	Priority
A	0	12	15	1
B	0	15	40	2
C	10	5	19	1
D	15	2	20	1
E	17	5	None	3
F	25	5	45	2
G	30	5	None	3
H	32	1	35	1

p.t.o.

2 You have been asked to design a system to control a road crossing across a railway line. The system, sketch in the figure, controls both the train stop lights, the road traffic lights and the road barrier. Analyse the system using a simple Petri net.



3 How does an RTOS differ from a conventional operating system? Describe a commercial real-time operating system.

4 Why is ADA a better real-time programming languages than FORTRAN or C?

5 What makes a computer control system safe?

You have been asked to design the control system for an modern fly-by-wire aircraft. The system has three main components – engine control, wing flaps and tail flaps. Each of these is controlled a number of computers reporting back to the central system. Sketch out a possible design. If the overall system has to have a failure probability < 10^{-10} / year what is the individual failure probabilities of each component in the system.