GX1493

OLLSCOIL NA hÉIREANN, GAILLIMH
THE NATIONAL UNIVERSITY OF IRELAND, GALWAY

SPRING EXAMINATIONS 2004

Third University Examination in Electronic and Computer Engineering (3BP1)

CT307: EMBEDDED SYSTEMS

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Time allowed: TWO hours

Answer question **1** and any **two** other questions of your choice
All questions carry equal marks

1. Why is scheduling such a crucial component of a real-time operating system. What is the difference between a hard and soft real-time task? The following table shows the arrival time, execution time, priority and dead-line for a number of processes. What scheduling algorithm is best for this set of tasks?

Process ID	Arrival Time (secs)	Execution Time (secs)	Deadline (secs)	Priority
1	0	5	10	2
2	1	1	4	1
3	1	12	20	2
4	6	10	25	2
5	10	2	15	1
6	10	3	17	1
7	11	3	17	1
8	15	20	n/a	Not real-time
9	17	3	30	2
10	18	5	35	2
11	25	1	30	1

2. Can any computer system be genuinely safe? Why is safety such a crucial component of real-time systems?

   A computer system consists of three processing units which replicate a calculation. Their results are then compared by voting system which requires a 2

out 3 agreement. If the failure probability of each of the systems for any calculation is 1 in 10^6. What is the probability that the system works.

3 Why is ADA a good real-time language?

A flight control program has to raise an exception if the descent speed exceeds 1000m/minute. How would this be done in ADA? What is the advantage of ADA over C for this type of problem.

4 What makes a good real-time operating system? You have been asked to design a simple system to control the opening and closing of two valves to regulate the flow of fuel in a power station. Describe the process by which you would decide which real-time operating system, if any, you would use?

5 Looking the figure which shows the opening and closing of a dock gate. The system consists of a tidal monitor which measures the height of the tide, a lock gate which opens when the tide reaches the same level as the water in the dock and closes again when the level drops back to this level after high tide. Before the dock gate opens or closes a sensor, S, determines whether there are any boats near the lock gate. If there are, the system waits until they have gone out of range. Analyse this problem with a Petri net.