

Total number of printed pages – 8

B. Tech
PECS 3405

Eighth Semester Examination – 2008

EMBEDDED SYSTEMS

Full Marks – 70

Time : 3 Hours

*Answer Question No. 1 which is compulsory
and any **five** from the rest.*

*The figures in the right-hand margin
indicate marks.*

1. Answer the following questions : 2×10
- (a) List down various hardware and software resources in an embedded computer system.
 - (b) Why the response time of LINUX is lower than WINDOWS operating system ?

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- (c) What are the parameters used to characterize a real time task ?
- (d) The performance of hierarchical memory system is faster. Why ?
- (e) Why embedded systems are realized as real time systems ?
- (f) Distinguish between hard, soft and firm real time systems.
- (g) Distinguish between periodic, aperiodic and sporadic tasks in a RTOS.
- (h) List down at least three tools that support the design and development of embedded system.
- (i) What do you mean by release time and response time of a real time tasks ?
- (j) List down various hardware and software drivers used in an embedded system.

- 2. (a) Explain the relationship between operating system, computer hardware, system software in an embedded system with the help of a schematic diagram. 4
- (b) What is a system call ? Explain the uses of system call in embedded system with an example. 4
- (c) The system calls are implemented as interrupt service routines. Justify. 2
- 3. (a) What do you mean by interface synthesis ? Illustrate how the communication time requirements are estimated using process-resource mapping and architectural inputs. 4
- (b) Describe a set of native communication application program interfaces in JAVA for the communication between JAVA and the system-on-chip. 6

4. (a) What are various criteria to be considered for processor scheduling in an embedded system? Explain various types of processor scheduling policies with examples. Which of these is followed in LINUX operating system? 5

(b) Five batch jobs A through E, arrive at a computer center at almost the same time. They have estimated running time of 10, 6, 2, 4 and 8 minutes. Their (externally determined) priorities are 3, 5, 2, 1 and 4 respectively, with 5 being the highest priority. For each of the following algorithms determine the mean process turn-around time. Ignore process switching overhead:

- (i) Round Robin
- (ii) Priority scheduling
- (iii) First come, first served (run in order 10, 6, 2, 4, 8)
- (iv) Shortest job first

For (i) assume that the system is multi-programmed and that each job gets its fair share of the CPU, for (ii) through (iii) assume that only one job at a time runs, until it finishes. All jobs are completely CPU bound.

5

5. (a) Discuss the role of tools for the development and debugging of embedded systems. What do you mean by run-control debugging and field debugging? 4

(b) How does the response time is affected by enabling/disabling interrupts in every kernel service call in a real-time operating system? 3

(c) Discuss the types of interrupts in embedded C. 3

6. (a) A virtual memory system has an address space of 8k words, a memory space of 4k words, and page and block sizes of 1k words. The following page reference changes occur during a given time interval. (Only page changes are listed, if the same page is referenced again, it is not listed twice).

4 2 0 1 2 6 1 4 0 1 0 2 3 5 7

Determine the four pages that are resident in main memory after each page reference change if the replacement algorithm used is (i) FIFO (ii) LRU. 5

- (b) Disk requests come into the disk driver for cylinders 10, 22, 20, 2, 40, 6 and 38 in that order. A seek takes 6 msec per

cylinder moved. How much seek time is needed for (i) First come, first served, (ii) Closest cylinder next, and (iii) Elevator algorithm (initially moving upward). In all cases, the arm is initially at cylinder 20. State advantages and disadvantages for each methods. 5

7. (a) Explain briefly different real time operating systems with examples. 4
- (b) What is the primary goal of a real-time operating system? 2
- (c) Why round-robin scheduling policy is appropriate for time-sharing operating systems? Explain with example. 4
8. (a) Explain the interprocess communication mechanisms in LINUX. 4

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(b) Discuss the message-based interprocess communication in embedded real-time systems and its appropriate operating system support. 3

(c) How an optimized communication mechanism can be obtained using message-based interprocess communication. 3

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