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CS – 051

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 1048

Roll No.

B. Tech.

(SEM. VIII) EXAMINATION, 2006-07

REAL TIME SYSTEMS

Time : 3 Hours]

[Total Marks : 100

- Note:*
- (1) Attempt *all* questions.
 - (2) All questions carry *equal* marks.
 - (3) Symbols occurring in this paper have their meanings based on Real Time Systems by Krishna and Shin.

- 1 Attempt any **four** parts of the following :
- (a) What is a real time system? Explain its various components with a suitable block diagram.
 - (b) What is an embedded system? Differentiate between embedded system and real time system.
 - (c) Explain the following terms with a suitable example.
 - (i) Periodic task
 - (ii) Sporadic task
 - (d) Explain the most important issues in Real-Time computing.
 - (e) Explain why predictability is an important requirement of a real time system? Discuss different techniques to enforce this requirement.
 - (f) What do you mean by temporal constraints? List possible task timing constraints.

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- 2 Attempt any **four** parts of the following:
- (a) Differentiate between firm real time systems and hard real time systems.
 - (b) What is a real time operating system? How it is different from general purpose operating system ?
 - (c) Why task synchronization is required in real time operating systems? Explain.
 - (d) Name two commercial RTOS other than Maruti, HART and VRTX. Discuss their capabilities/ requirements.
 - (e) Compare the design approach of Maruti II RTOS with VRTX real time operating system.
 - (f) Describe the architecture and functions of I/O sub system of HART OS.
- 3 Attempt any **two** parts of the following :
- (a) What is rate monotonic scheduling algorithm? What are various assumption in this algorithm? Explain rate monotonic scheduling algorithm with a suitable example.
 - (b) Prove that if there are two tasks T_1 , T_2 and
$$\frac{e_1}{p_1} + \frac{e_2}{p_2} \leq 2(\sqrt{2} - 1)$$
then the tasks are rate monotonic schedulable.

- (c) Differentiate between fixed priority and dynamic priority scheduling algorithms. Construct a set of periodic tasks (with release times, execution times, and periods) which can be scheduled feasibly by the EDF algorithm, but not by the RM algorithm.

4 Attempt any **two** parts of the following:

- (a) Discuss various approaches used for real-time software specification and verification and then discuss the duration calculus approach in brief.
- (b) Define real-time communication. Explain VTCSMA (virtual time carrier-sensed multiple access) protocol with a suitable example.
- (c) Consider the use of the timed-token protocol in the following situation. We have five nodes in the system. The real-time requirement is that node n_i be able to put out upto b_i bits over each period of duration P_i , where b_i and P_i are as given in the following table :

node	b_i	P_i
h_1	1K	10000
h_2	4K	50000
h_3	16K	90000
h_4	16K	90000

the overhead is negligible, and the system bandwidth is 1K/unit time. (This is, it takes one unit time to transmit 1 kB of data). Choose an appropriate TTRT and obtain suitable values of f_i .

- 5 Attempt any **two** parts of the following :
- (a) What do you mean by fault tolerance? How faults are classified according to their temporal behaviour and output behaviour? Discuss various types of redundancies required to design a fault tolerant system.
 - (b) Define notion of clock and clock synchronization in context of real time systems. Explain non fault tolerant synchronization algorithm.
 - (c) Discuss the most important issues in Real time software design. Explain how the principles of object oriented paradigm may be applied in large dynamic real time systems.
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