

Birla Institute of Technology and Science, Pilani, Rajasthan
BITS G553 Real Time Systems
First Semester 2015-16

Comprehensive Examination (Regular)

Max. Marks 25

2-12-2015

Suggested Time: 60 Min

Note: Please answer the questions concisely to the point

- 1) What is clean room testing? [1]
- 2) How is voting mechanism useful in making a Real time system fault tolerant? [1]
- 3) What is the difference between reliability and correctness? [1]
- 4) How do we ensure software's interoperability and portability? [1]
- 5) What are the advantage and disadvantage of a task Control Block method of maintaining task information? [1]
- 6) The software for an embedded system could go into an infinite loop due to a bug. How can we avoid it so that this such faulty working can be avoided? [1]
- 7) a) An operation $R=R+A*B$ is to be performed in 0-address machine, 1- address, 2-address and 3-address machines. Write the machine code instructions for each of these processor architectures.

b) Now assume that each instruction in 0-address machine takes 10ns, in 1-address machine takes 12ns, in 2-address machine takes 15ns and in 3-address machine takes 20ns. Now calculate the execution time taken for the above arithmetic operation in each of these machine architecture. [6]
- 8) What is internal and external fragmentation? How do we reduce/remove each of them? Also write a sentence or two about the feasibility of these methods to reduce these fragmentations in real time systems? [3]
- 9) A job J2 can execute only after J1 has completed. Similarly J4 can execute only after J3 has completed. J5 can execute only if J2, J4 and J0 have executed and J6 can occur only if any of two jobs among J2, J4 and J0 have executed. The job J6 produces an output (data) which is processed by job J7. J7 executes as long as J6 produces output. Depict the above dependencies using an appropriate graph. [4]
- 10) A task set T1 (5,1) T2(4,2) T3(2,0.5,4) are to be scheduled using a scheduling algorithm. Schedule the above tasks using the following algorithms.
 - a. RMA
 - b. DMA
 - c. EDFComment about its schedulability. [6]

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Max. Marks 45 2-12-2015 Suggested Time: 120 Min

Note: Please answer all the parts of a question in one place

1. Consider the following task set, where release time of the tasks r , their execution time e and priority P is given. Their requirement of resources is also given. Draw a schedule diagram for the five tasks from time 0 to 20 using the Priority-Ceiling Protocol. Find out the blocking time of each task.

For each task the corresponding critical section starts one time unit after the task started executing. Each nested critical section starts 1.5 time units after the begin of the previous critical section. Lower the number, higher the priority

Task T_i	(r, e, P)	Resource requirement
T_1	(7,3,1)	R_1 for 1 time unit
T_2	(5,3,2)	R_2 for 1 time unit
T_3	(4,2,3)	No resource
T_4	(2,6,4)	R_1 for 4 and R_2 for 1.5 time units(nested)
T_5	(0,6,5)	R_2 for 4 time units

[6 + 5 = 11]

2. A system of three tasks $T_1 = (4,1)$, $T_2 = (4,1.5,6)$, $T_3 = (5,0.5)$ is scheduled using sporadic server with T_1 as T_{ss} and RMS algorithm. A stream of sporadic jobs arrives as follows.

$S = \{(2,2,8), (2,2,18), (8, 2,18)\}$

Use acceptance formula for sporadic jobs scheduled under a sporadic server to valid accept/reject decisions. Find $\sigma_{s,1}$, $\sigma_{s,2}$, $\sigma_{s,3}$. (No need to draw the schedule)

[10]

3. A system of five periodic tasks $T_i \{(5, 1); (7, 1); (8, 1); (12, 1.5); (25, 4)\}$ is found to be schedulable using RMA. Now find out the maximum value of context switch 'CS', such that the system remains schedulable

[15]

4. Use Petri-Net to describe multiplication of two 2×2 matrices. Also give firing table.

[9]