

Assignment 8

MCQ:

1. Which of the following pair of tasks can be scheduled by the EDF algorithm?(Task T : T(p,c))

- A. T(3,4) and T(5,5)
- B. T(6,2) and T(9,8)
- C. T(7,2) and T(7,1)
- D. None of the above

Solution: Option C. T(7,2) and T(7,1)

Explanation: By the EDF algorithm, tasks can be scheduled if and only if $util \leq 1$

Option A. $util = 4/3 + 5/5 = 2.33 > 1$

Option B. $util = 2/6 + 8/9 = 1.22 > 1$

Option C. $util = 2/7 + 1/7 = 0.43 < 1$

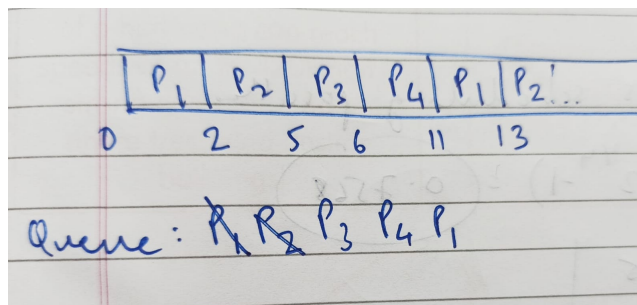
Hence, Option C is correct.

2. Consider the following set of tasks P1(9,2), P2(5,3), P3(2,1), P4(8,5). What is the state of execution at time t=13?

- A. P2 gets preempted and P1 starts to execute.
- B. P4 is running.
- C. P1 gets preempted and P2 starts to execute.
- D. P3 is running.

Solution: Option C. P1 gets preempted and P2 starts to execute.

Explanation: Gantt chart-



3. Are two identical tasks whose period is thrice the value of execution time schedulable by EDF?

- A. Yes
- B. No
- C. Data insufficient

Solution: Option A. Yes

Explanation: Let execution time(c) = x. Therefore, period = 3x and

util (for two processes) = $x/3x + x/3x = 2/3 < 1$. Hence, the processes are schedulable by EDF.

4. What were the problems faced by the Mars Pathfinder?

- A. Priority extension
- B. Priority preemption
- C. Priority inversion
- D. None of the above

Solution: Option C. Priority inversion

Explanation: Fact

5. Which of the following are possible solutions to the priority inversion problem?

- A. Disabling all interrupts.
- B. Priority ceiling protocol.
- C. Random boosting.
- D. All of the above.

Solution: Option D. All of the above.

Explanation: Disabling all interrupts leads to formation of only two priorities: preemptible and interrupt-disabled. Priority ceiling protocol ensures that the semaphore of the critical section has a very high priority. Random boosting boosts tasks holding high priority randomly to ensure the avoidance of priority inversion.

6. Priority ceiling protocol supports

- A. Static priority scheduling
- B. Dynamic priority scheduling
- C. Both A and B
- D. None of the above

Solution: Option B. Dynamic priority Scheduling

Explanation: Priority ceiling protocol raises the priority of certain tasks in certain situations and hence requires a dynamic priority scheduler.

7. Which of the statements regarding component-based designs are false?

- A. System must be composed of components.
- B. Behavior must be easily derivable from the subsystems.
- C. Timing specification is not mandatory.
- D. Concurrency is a must.

Solution: Option C. Timing specification is not mandatory.

Explanation: Timing specification is mandatory in component based designs.

8. Which of the following are the requirements for specifications and building techniques?

- A. Presence of programming elements.
- B. Executability.
- C. Support for the design of large systems.
- D. All of the above.

Solution: Option D. All of the above.

Explanation: Fact

9. The relation among the components can be represented using

- A. Finite State Machines
- B. Linear Equations
- C. Both A and B.
- D. None of the above

Solution: Option A. Finite State Machines

Explanation: The relation among the components can be represented using Finite State Machines, Differential Equations, Petri nets, and discrete event models.

10. Which statement is true regarding synchronous communication?

- A. It has a huge overhead.
- B. There is a lack of error detection.
- C. There is no buffer overflow and loss of data is avoided.
- D. All of the above.

Solution: Option C. There is no buffer overflow and loss of data is avoided.

Explanation: Synchronous communication has low overhead and error detection is easier than asynchronous communication.

Short-Answer type(Alphanumeric answers only):

11. Consider three tasks T1(9,5), T2(4,1), and T3(7,2). Find the difference between the current execution time of T3 and the new execution time of T3 if all the tasks have to be schedulable according to the EDF algorithm(Upto one decimal place).

Solution : 0.6

Explanation: $util = 5/9 + 1/4 + 2/7 = 1.08 > 1$ (currently not schedulable)

For tasks to be schedulable by the EDF algorithm, $util \leq 1$.

Therefore, for all tasks to be schedulable, util needs to be decreased by 0.08.

util for T3 = $2/7 = 0.28$. New util = $0.28 - 0.08 = 0.2$.

Therefore, the new execution time = $7 * 0.2 = 1.4$

Difference = $2 - 1.4 = 0.6$

12. Consider four tasks T1(9,3), T2(5,1), T3(6,2), and T4(9,1). Find the difference between the maximum CPU utilization while scheduling these tasks in EDF and RMS algorithm(Upto two decimal places).

Solution: 0.24

Explanation: max util for EDF = 1; max util for RMS = $4(2^{1/4} - 1) = 0.76$

Difference = $1 - 0.76 = 0.24$