Course outline

How does an NPTEL online course work?

Week 0

Week 1

Week 2

Week 3

Week 4

Week 5

Week 6

- Lecture 26 : Resource Sharing Among Real-Time Tasks
- Lecture 27 : Basic priority inheritance protocol (PIP)
- Lecture 28 : Highest Locker Protocol (HLP)
- Lecture 29 : Priority Ceiling Protocol (PCP)
- Lecture 30 : Working of Priority Ceiling Protocol
- Lecture 31 : Analysis of Priority Ceiling Protocol
- Lecture Materials
- Quiz: Week 6 : Assignment 6
- Feedback Form of Week 6

Week 7

Week 8

Week 9

Week 10

Week 11

Week 12

Assignments Solution

Download Videos

Live Interactive Session

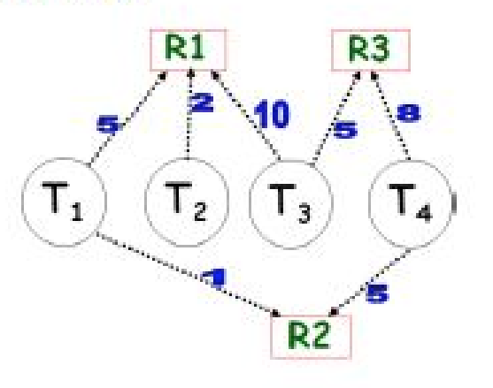
Week 6 : Assignment 6

The due date for submitting this assignment has passed.

Due on 2021-09-08, 23:59 IST.

As per our records you have not submitted this assignment.

1) Assume that four periodic real-time tasks T1, T2, T3, and T4 share three non-preemptable resources R1, R2, and R3 as shown in the following diagram. The time for which a task needs a resource is annotated on the arrow connecting the task to the resource. The tasks are arranged in decreasing order of their priorities. That is, T1 is the highest priority task and T4 is the lowest priority task. The tasks are scheduled using a rate monotonic scheduler and the basic priority inheritance protocol is used for resource arbitration. What is the maximum duration for which the task T3 would undergo inheritance blocking? *1 point*



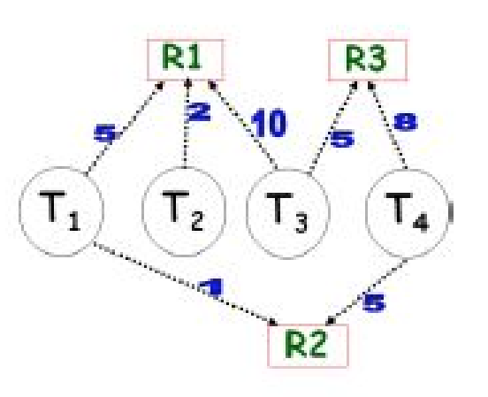
a. 5 units
b. 8 units
c. 13 units
d. 5 units
e. 1 unit

○ a.
○ b.
○ c.
○ d.
○ e.

No, the answer is incorrect.
Score: 0

Accepted Answers:
a.
OR
d.

2) Assume that four periodic real-time tasks T1, T2, T3, and T4 share three non-preemptable resources R1, R2, and R3 as shown in the following diagram. The time for which each task needs a resource is annotated on the arrow connecting the task to the resource. The tasks are arranged in decreasing order of their priorities. That is, T1 is the highest priority task and T4 is the lowest priority task. The tasks are scheduled using a rate monotonic scheduler and the highest locker protocol is used for supporting resource sharing. What will be the ceiling priority of the resource R1? *1 point*



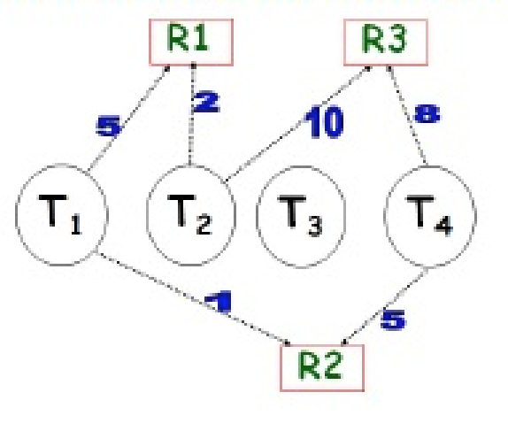
a. Priority of T1
b. Priority of T2
c. Priority of T3
d. Priority of T4

○ a.
○ b.
○ c.
○ d.

No, the answer is incorrect.
Score: 0

Accepted Answers:
a.

3) Assume that four periodic real-time tasks T1, T2, T3, and T4 share three non-preemptable resources R1, R2, and R3 as shown in the following diagram. The time for which each task needs a resource is annotated on the arrow connecting the task to the resource. The tasks are arranged in decreasing order of their priorities. That is, T1 is the highest priority task and T4 is the lowest priority task. The tasks are scheduled using a rate monotonic scheduler and the highest locker protocol is used for resource arbitration. Which tasks would undergo direct blocking? *1 point*



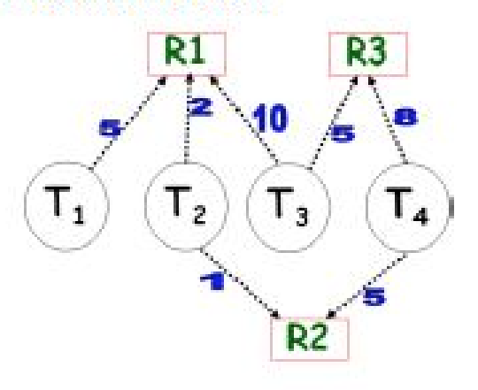
a. T1, T2, and T4
b. T1, T2 , and T3
c. T1 and T2
d. T1 and T4
e. T2 and T4
f. T2 only

○ a.
○ b.
○ c.
○ d.
○ e.
○ f.

No, the answer is incorrect.
Score: 0

Accepted Answers:
c.

4) Assume that four periodic real-time tasks T1, T2, T3, and T4 share three non-preemptable resources R1, R2, and R3 as shown in the following diagram. The time for which each task needs a resource is annotated on the arrow connecting the task with the corresponding resource. The tasks are arranged in decreasing order of their priorities, with T1 being the highest priority task and T4 the lowest priority task. The tasks are scheduled using a rate monotonic scheduler and the priority ceiling protocol (PCP) is used for supporting resource sharing. What is the maximum duration for which the task T3 would suffer avoidance related inversion? *1 point*



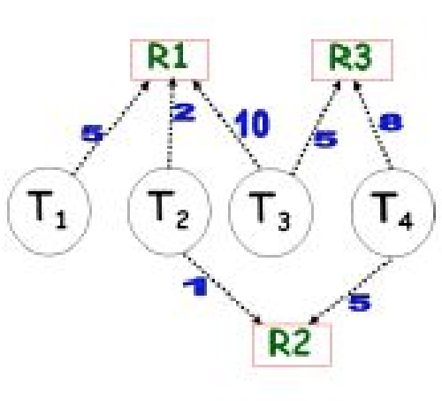
a. 1
b. 2
c. 5
d. 8
e. 10
f. 0

○ a.
○ b.
○ c.
○ d.
○ e.
○ f.

No, the answer is incorrect.
Score: 0

Accepted Answers:
f.

5) Assume that four periodic real-time tasks T1, T2, T3, and T4 share three non-preemptable resources R1, R2, and R3 as shown in the following diagram. The time for which a task needs a resource is annotated on the arrow connecting the task to the resource. The tasks are arranged in decreasing order of their priorities. That is, T1 is the highest priority task and T4 is the lowest priority task. The tasks are scheduled using a rate monotonic scheduler and the priority ceiling protocol (PCP) is used for resource sharing. Which task would not suffer any avoidance related inversions? *1 point*



a. T1
b. T2
c. T3
d. T4

○ a.
○ b.
○ c.
○ d.

No, the answer is incorrect.
Score: 0

Accepted Answers:
a.

6) Consider a real-time system in which a set of static priority periodic real-time tasks are scheduled using a rate monotonic (RM) scheduler. These tasks share some critical resources using the priority ceiling protocol (PCP). Assume that a task is using a critical resource CR at an instant, what can be said about its priority? *1 point*

a. It inherits the ceiling priority value associated with the resource CR.
b. Its priority value remains unchanged, if no other task is waiting to use the resource CR
c. Its priority value remains unchanged, even if other tasks are waiting to use the resource CR
d. It inherits the priority of a task intending to use the resource
e. It inherits the maximum of the priorities of the tasks waiting to use the resource

☐ a.
☐ b.
☐ c.
☐ d.
☐ e.

No, the answer is incorrect.
Score: 0

Accepted Answers:
b.
e.

7) Consider that a set of periodic hard real-time tasks {T1… T6} in a system are scheduled using a rate monotonic (RM) scheduler. These tasks share certain critical resources using the priority ceiling protocol (PCP). Which of the following sentences are **true** for this system? *1 point*

a. If the task T1 can suffer inheritance blocking by the task T2 for a certain duration, then T1 may also suffer deadlock avoidance-related inversion for the same duration due to T2.
b. A task not needing any resource may undergo inheritance related inversions.
c. A task instance undergoes at most one direct blocking
d. A task not needing a resource can undergo avoidance blocking
e. It is possible that every task in the set {T1,..,T6} might suffer from some inversion or other

☐ a.
☐ b.
☐ c.
☐ d.
☐ e.

No, the answer is incorrect.
Score: 0

Accepted Answers:
b.
c.

8) Which of the following are **false** of the priority ceiling protocol (PCP)? *1 point*

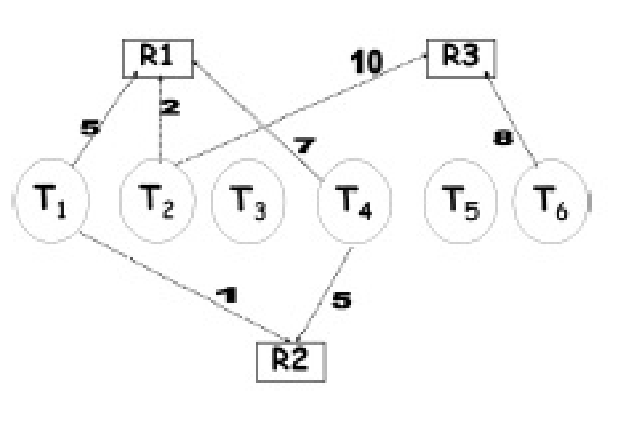
a. It is the protocol of choice for use in a situation where a set of serially reusable and preemptable resources are to be shared among a set of periodic hard real-time tasks.
b. It prevents any deadlocks arising from resource sharing.
c. It prevents any chain blocking arising from resource sharing.
d. It prevents unbounded priority inversions.
e. It completely prevents inheritance-related inversions.

☐ a.
☐ b.
☐ c.
☐ d.
☐ e.

No, the answer is incorrect.
Score: 0

Accepted Answers:
a.
e.

9) Consider that in a system a set of six periodic real-time tasks {T1… T6} are scheduled using a rate monotonic scheduler. The tasks have been labelled in decreasing order of their priority. That is, T1 is the highest priority task and T6 is the lowest priority task. The tasks share 3 critical resources: R1, R2, and R3. The specific resources that each task uses are shown using dotted arrows and the time for which the task needs to use a resource has been annotated on the arrow. Which tasks may undergo direct inversion? *1 point*



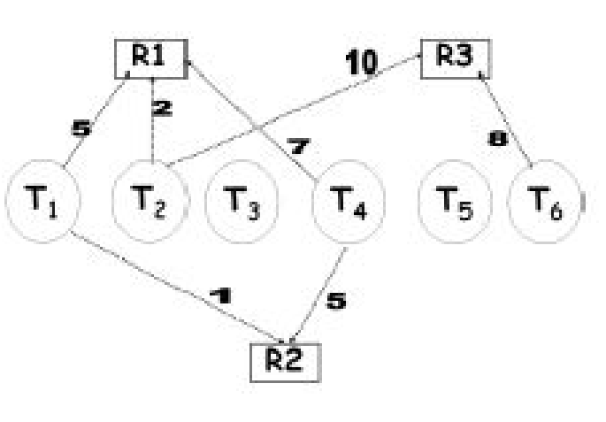
a. T1
b. T1, T2
c. T4,T6
d. T2,T4,T6
e. T1,T2, T4, T6

○ a.
○ b.
○ c.
○ d.
○ e.

No, the answer is incorrect.
Score: 0

Accepted Answers:
b.

10) Consider that a set of six periodic real-time tasks {T1… T6} in a system are to be scheduled using a rate monotonic scheduler. The tasks have been labelled in decreasing order of their priority. That is, T1 is the highest priority task and T6 is the lowest priority task. The tasks share 3 critical resources: R1, R2, and R3. The specific resources that each task uses are shown using dotted arrows and the time for which the task needs to use a resource has been annotated on the arrow. Which tasks may undergo inheritance-related inversion? *1 point*



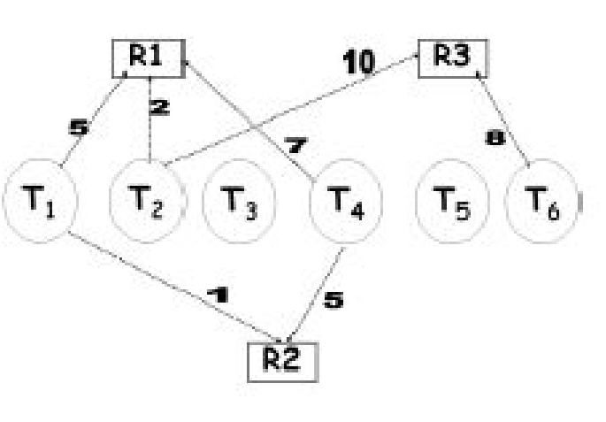
a. T3
b. T3,T4,T5
c. T3,T4,T5,T6
d. T2,T3,T4,T5
e. T1,T2, T4, T6

○ a.
○ b.
○ c.
○ d.
○ e.

No, the answer is incorrect.
Score: 0

Accepted Answers:
d.

11) Consider that a set of six periodic real-time tasks T1… T6 in a system are scheduled using a rate monotonic scheduler. The tasks have been labelled in decreasing order of their priority. That is, T1 is the highest priority task and T6 is the lowest priority task. The tasks share 3 critical resources: R1, R2, and R3. The specific resources that each task uses are shown using dotted arrows from the task to the resources and the time for which a task needs to use a resource has been annotated on the arrow. Which tasks may undergo avoidance-related inversion? *1 point*



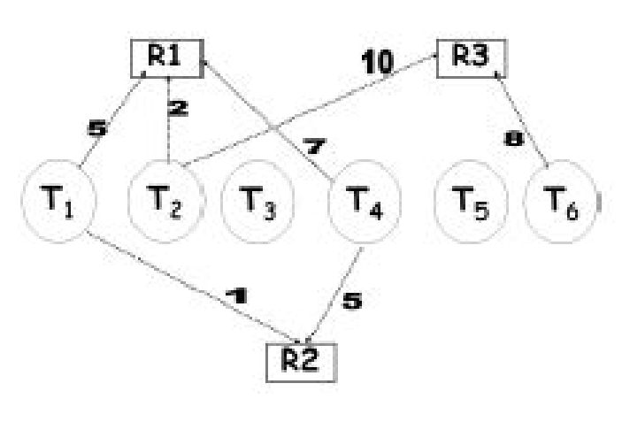
a. T4
b. T1,T2
c. T2,T4
d. T3,T4,T5,T6
e. T2,T3,T4,T5

○ a.
○ b.
○ c.
○ d.
○ e.

No, the answer is incorrect.
Score: 0

Accepted Answers:
c.

12) Consider that a set of six periodic hard real-time tasks {T1… T6} in a system are scheduled using a rate monotonic scheduler. The tasks have been labelled in decreasing order of their priority. That is, T1 is the highest priority task and T6 is the lowest priority task. The tasks share 3 critical resources: R1, R2, and R3. The specific resources that each task uses are shown using dotted arrows from the task to the resources and the time for which the task needs to use a resource has been annotated on the arrow. What is the maximum duration for which the task T1 can undergo priority inversion? *1 point*



a. 0 units
b. 5 units
c. 7 units
d. 10 units
e. 12 units

○ a.
○ b.
○ c.
○ d.
○ e.

No, the answer is incorrect.
Score: 0

Accepted Answers:
c.