MID TERM-I
OPERATING SYSTEM, ITPC 20
Time limit: 9: 45 am to 11:15 am
Date:23.2.21
B.Tech (IT) 4th Semester
Attempt any Five questions

1.(a) Why is it important for the scheduler to distinguish T /0-bound programs from CPU-bound programs? (1 marks)

(b) Consider a system running ten I/O-bound tasks and one CPU-bound task. Assume that the I/O-bound tasks issue an I/O operation once for every millisecond of CPU computing and that each I/0 operation takes 10 milliseconds to complete. Also assume that the context-switching overhead is 0.1 millisecond and that all processes are long-running tasks. Describe the CPU utilization for a round-robin scheduler when:

a. The time quantum is 1 millisecond

b. The time quantum is 10 milliseconds

(2 marks)

Q2. Consider the following snapshot of a system running n processes. Process i is holding Xi instances of a resource R, 1 <= i <= n. currently, all instances of R are occupied. Further, for all i, process i has placed a request for an additional Yi instances while holding the Xi instances it already has. There are exactly two processes p and q such that Yp = Yq = 0. Which one of the following can serve as a necessary condition to guarantee that the system is not approaching a deadlock? Explain your answer (3 marks)

a. min (Xp, Xq) < max (Yk) where k != p and k != q

b. Xp + Xq >= min (Yk) where k != p and k != q

c. max (Xp, Xq) > 1

d. min (Xp, Xq) > 1

Q3 Consider a system with 4 types of resources R1 (3 units), R2 (2 units), R3 (3 units), R4 (2 units). A non-preemptive resource allocation policy is used. At any given instance, a request is not entertained if it cannot be completely satisfied. Three processes P1, P2, P3 request the sources as follows if executed independently.

Process P1:
t=0: requests 2 units of R2
t=1: requests 1 unit of R3
t=3: requests 2 units of R1
t=5: releases 1 unit of R2
and 1 unit of R1.
t=7: releases 1 unit of R3
t=8: requests 2 units of R4
t=10: Finishes

Process P2:
t=0: requests 2 units of R3
t=2: requests 1 unit of R4
t=4: requests 1 unit of R1
t=6: releases 1 unit of R3
t=8: Finishes

Process P3:
t=0: requests 1 unit of R4
t=2: requests 2 units of R1
t=5: releases 2 units of R1
t=7: requests 1 unit of R2
t=8: requests 1 unit of R3
t=9: Finishes

Which one of the following statements is TRUE if all three processes run concurrently starting at time t=0? Explain your Answer **(**3 marks)

A All processes will finish without any deadlock

B Only P1 and P2 will be in deadlock.

C Only P1 and P3 will be in a deadlock.

D All three processes will be in deadlock

Q4. Consider a system implementing multilevel queue scheduling. What strategy can a computer user employ to maximize the amount of CPU time allocated to the user's process? (1 marks)

Consider the exponential average formula used to predict the length of the next CPU burst. What are the implications of assigning the following values to the parameters used by the algorithm? Explain (2 marks)
a. ex = 0 and *To* = 100 milliseconds
b. ex= 0.99 and *To* = 10 milliseconds

Q5.
(a) Consider the following resource-allocation policy. Requests for and releases of resources are allowed at any time. If a request for resources cannot be satisfied because the resources are not available, then we check any processes that are blocked waiting for resources. If a blocked process has the desired resources, then these resources are taken away from it and are given to the requesting process. The vector of resources for which the blocked process is waiting is increased to include the resources that were taken away. For example, consider a system with three resource types and the vector *Available* initialized to (4,2,2). If process *Po* asks for (2,2,1), it gets them. If P1 asks for (1,0,1), it gets them. Then, if *Po* asks for (0,0,1), it is blocked (resource not available). If *P2* now asks for (2,0,0), it gets the available one (1,0,0) and one that was allocated to *Po* (since *Po* is blocked). Po's *Allocation* vector goes down to (1,2,1), and its *Need* vector goes up to (1,0,1). (3 marks)
a. Can deadlock occur? If you answer "yes," give an example. If you

answer "no," specify which necessary condition cannot occur.
b. Can indefinite blocking occur? Explain your answer.

Q6.
(a) Consider a system consisting of *m* resources of the same type being shared by *n* processes. A process can request or release only one resource at a time. Show that the system is deadlock free if the following two conditions hold: (2 marks)
a. The maximum need of each process is between one resource and *m* resources.
b. The sum of all maximum needs is less than *m* + *n.*

(b) If there are 100 units of resource R in the system and each process in the system requires 2 units of resource R, then how many processes can be present at maximum so that no deadlock will occur? (1 marks)

Incase of any query, pl contact Dr. Priyanka Ahlawat
9034996998
priyankaahlawat@nitkkr.ac.in