BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
SECOND SEMESTER 2017-2018
CS F372 Operating Systems
Mid Semester Test (Closed Book)
Date: 07-03-2018

Time: 90 Min | Max Marks: 70 (35%)

Instructions:

1. Write all the sub parts of each question together.
2. Write the answers neatly. Over written answers will not be considered for recheck.

Q1. Consider a system that has to execute three processes A_1, A_2 and B_1. These processes are divided into two groups G_A and G_B such that A_1 and A_2 belong to group G_A whereas B_1 belong to group G_B. The weights of groups G_A and G_B are 0.4 and 0.6. The base priorities of A_1, A_2 and B_1 are 50, 44 and 48 respectively. The priority is calculated after every one unit of time. Assume 130 clock ticks are generated in one time unit. Schedule the above system using Fair Share Scheduler. Show the tabular representation of the execution sequence of the three processes for five seconds. In case of tie, process A_1 gets priority over A_2 and A_2 gets priority over B_1.

[10 M]

Q2-a. There are four cooperating processes P_1, P_2, P_3 and P_4 which need synchronization in order to ensure the order of instruction execution as these processes are sharing the common variables among them. Following are the set of instructions that the processes are suppose to execute:

P_1: read(x_1); $a = x_1 + 2x_3$; $w = a \times b$;	P_2: read(x_2); write(a); $d = x_1 + x_2$;	P_3: read(x_3); $b = ++x_2$; $y = d/c$;	P_4: read(x_4); $c = 4x_3 + x_4$; $z = w - y$;

Write the pseudo-code for these four processes using binary semaphores to achieve the required synchronization. Assume there is only one reading device.

Q2-b. The pseudo codes of two cooperating processes A and B are given below. These processes use two binary semaphores P and Q with initial values set to 1. Can these processes stuck in indefinite blocking. If yes, then show the execution sequence of these processes that lead to indefinite blocking state.

Process A	Process B
Wait (P);	Wait (Q);
Wait (Q);	Wait (P);
<C S>	<C S>
Signal(P);	Signal(Q);
Signal(Q);	Signal(P);

[12 + 5 = 17M]

Q3-a. For the following set of processes, show the schedule using Gantt chart. Compute normalized turnaround time for each process, average response time, average wait time and throughput for the following process scheduling techniques:

q=4 V, RR

Process	Arrival	CPU Burst
P_1	0	20 ✓
~~P_2~~	~~3~~	~~10~~ ✓
P_3	5	25 → 5 −3 −20
~~P_4~~	~~15~~	~~15~~
~~P_5~~	~~17~~	~~5~~

SRTF

i. Shortest Remaining Time First

ii. Virtual Round Robin: Consider a time quantum of 4 units. Let process P_3 goes for input/output operation for 3 units of time after executing for 5 units of time.

P3

Q3-b. A shared variable **A** is initialized to 0 and is processed by four processes P, Q, R and S. Processes P and Q increment A by 2 whereas processes R and S decrement the value of A by 3. The reading, updating and writing operations on shared variable **A** are performed in a mutually exclusive manner.

i. Write the pseudo code for all the four processes in order to synchronize their actions. Make use of binary semaphore.

ii. Find out the value of **A** after execution of all the processes if the semaphore value is initialized to 1.

[18 + 6 = 24M]

Q4. Answer the following:

i. Why acquire and release lock operations should be done atomically?

ii. What is a race condition?

iii. What is the benefit of using cache memory?

iv. Explain the events in which a process is switched to Ready/Suspend state.

v. Can a process executing in critical section be preempted? Justify with reason.

vi. Why the time quantum used in round robin scheduling should not be too large or too small?

vii. What is a busy wait state? How to overcome this state.

viii. How to ensure that a task will not miss the deadline when scheduled using rate monotonic scheduling?

ix. Why earliest deadline first scheduling algorithm performs better than rate monotonic schedulin algorithm?

x. For the following pseudo code of processes P_0 and P_1, justify the correctness of semaphore usage ar mention the cause of execution of these processes. Binary semaphore S is initialized to 1.

Process P_0	Process P_1
Signal(S);	Signal(S);
<C S>	<C S>
Wait(S);	Wait(S);

xi. What are the requirements that a solution to critical section problem should satisfy?

[19M

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