İstanbul Bilgi University

Department of Computer Engineering

SPRING, 2021
Campus: Santral

CMPE 312: OPERATING SYSTEMS

Quiz 2 - Morning (ODD)

(Duration: 60 minutes)

Name :

Student ID :

NOTE: WRITE NEATLY. MARKS WILL BE GIVEN FOR PARTIAL ANSWERS. THEREFORE, SHOW YOUR WORK AND YOUR REASONING. YOU MAY GET EXTRA POINTS FOR AN APPROPRIATE OBSERVATION OR YOU MAY LOSE SOME MARKS DUE TO AN OBSCURE SOLUTION. This exam is for students having a student number ending by 1, 3, 5, 7, 9.

CONTINUED

1. {100 points} Modern Operating Systems must tackle the challenges of Synchronization and Deadlock. 'Process Synchronization' is the task of coordinating the execution of processes in a way that no two processes can have access to the same shared data or resource. A process requesting a resource may have to wait, if the resource is not available at that time. Sometimes, a waiting process is never able to change state, because the resources it has requested are held by other waiting processes; this situation is called 'Deadlock'.

(a) {40 points} In concurrent programming, a "critical section" is a part of a multi-process program that may not be concurrently executed by more than one of the program's thread. Let us consider a 2 processes solution:

```
do {
      flag[i] = TRUE;
      while(flag[j]); %wait
      CRITICAL SECTION
      flag[i] = FALSE;
      REMAINDER SECTION
      } while (TRUE);
Pseudo-code of $P_i$ (the one of $P_j$ is symmetric)
```

(i) {10 points} Does the given solution sattisfy the mutual exclusion requirement? Explain (a simple 'yes-no' answer is NOT enough. What is the mutual exclusion requirement? Why is (not?) sattisfied?)

(ii) {10 points} Does the given solution sattisfy the progress requirement? Explain

(iii) {10 points} Does the given solution have the risk of deadlock? Make a simulation to support your answer (no point without a valid simluation)

(iv) {10 points} If your answer to the previous question is positive (i.e. Yes, there is the risk of deadlock), how can you modify the given solution to make it working?

(b) {60 points} Considering the pseudo-code of the wait() and the signal() system calls with NO busy waiting:

(i) {40 points} Make your own UNIQUE and ORIGINAL simulation where 5 processes (P_j, $P_?$, $P_{??}$, $P_{???}$ and $P_{????}$)[1] want to enter the same critical section: at every row of the simulation show ALL interesting parameters, e.g. S.value, S.L, and make appropriate comments. The simulation must stores at least 8 rows.

(ii) Assuming that, at time t, the process control block of P_j is in the queue of S.L:

A. {5 points} Which is the current state of P_j?

B. {5 points} Does P_j have a partition in Main Memory (MM)? Explain (no point without explanation).

(iii) Assume that at time $t+1$ the medium term scheduler runs and swaps out P_j:

A. {5 points} Which is the current state of P_j?

B. {5 points} Does P_j have a partition in Main Memory (MM)? Explain (no point without explanation).

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[1] Please, name the processes as you wish to create your own UNIQUE and ORIGINAL exam.