United International University

Department of Computer Science and Engineering
CSI 309: Operating System Concepts
Midterm Examination
Summer 2021

Time: 1 Hour 15 Minutes **Full Marks: 20**

[Any examinee found adopting unfair means will be expelled from the trimester/program as per UIU disciplinary rules.]

[**Answer all the questions. Figures in the right margin indicate marks.**]

1.
   a) What is the main advantage for an operating system designer of using virtual machine architecture? How does the guest operating system function on the host operating system? **Describe** with a figure. [Hint: VMWare]   1+2

   b) **Differentiate** between CPU scheduler and Job scheduler. Why does Job scheduler define the degree of multiprogramming?   1+1

   c) What is the purpose of system calls? Show the transition from user mood to kernel mood with the help of a system call.   1+1

2.
   a) What is fragmentation? Consider two scenarios: 2
      i.   A process requires 23 Mb and allocated memory is 25 Mb.
      ii. A process requires 100 Mb and allocated memory is 100 Mb of noncontiguous memory space.

      Briefly explain internal and external fragmentation for the above two scenarios.

   b) Given five memory partitions of 150 KB, 550 KB, 250 KB, 350 KB and 650 KB (in order), how would each of the *first fit*, *best fit* and *worst fit* algorithms place processes of P_1=260 KB, P_2=470 KB, P_3=165 KB and P_4=460 KB (in order)? Which algorithm makes the most efficient use of memory? **Justify** your answer.   2

c) Since the page table is also kept in main memory, what issue does it create? 1+2
Consider a paging system with TLB hit ratio of 85%. If the memory access time is 100 nanoseconds and the searching time for TLB is 30 nanoseconds, **Calculate** the effective memory access time?

3. a) What are the reasons that processes are swapped out? Which scheduler 1+1 performs this swapping?

Which of the following process state transition is incorrect and **mention** its reason?

  i.   Waiting(Blocked) → Running
  ii. Ready → Running
  iii. Running → Ready
  iv. Running → Waiting(Blocked)

b) **Calculate** the average waiting time for the following processes using the round 2+2 robin, and preemptive shortest job first scheduling algorithm. Time quantum = 4 ms. **Draw** Gantt chart for each algorithm.

Table 1: Process Burst Time, Arrival Time and Priority

Process	Arrival Time	Burst Time
P1	0	4
P2	1	5
P3	2	2
P4	3	1
P5	4	6
P6	6	3