United International University

Department of Computer Science and Engineering

CSE 4509: Operating Systems

Midterm Examination

Spring 2022

Time: 1 Hour 45 Minutes **Full Marks: 30**

[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) Operating system is the resource manager of a Computer. Justify the comments with the help of a CPU instruction execution such as ***MUL*** R_1, R_2, R_3 where value of R_1 and R_2 are coming from memory and value of R_3 will be saved into memory after the successful execution of this instruction. [Here, R_1, R_2, R_3 are CPU register] 3

b) Mention differences among command line interpreter and graphical user interface. Write short note on Bootstrap loader with concentration to GRUB. 1+1

c) What is meant by micro-kernel structure? How micro-kernel architecture increase communication overhead? Explain with necessary diagram. 1+2

2. a) What is fragmentation? Consider two scenarios: 2

   i. A process requires 25 Mb and allocated memory is 30 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, 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? Which algorithm makes the most efficient use of memory? **Justify** your answer. 2

c) Briefly explain the double memory access problem cause by paging? How is it solved? Consider a paging system with TLB hit ratio of 92%. If the memory access time is 113 nanoseconds and the searching time for TLB is 37 nanoseconds, **Calculate** the effective memory access time by two methods and compare the result? 3

a) What are the reasons that processes are swapped out? Which scheduler 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)

1

b) Write down the output of the following program:

```
#include<stdio.h>

#include<sys/types.h>

void main(){

 int num = fork();

 if (num == 0) { fork(); }

 else { printf("Reached here! \n"); }

printf("Hello! \n"); }
```

c) Producer-consumer problem is classical problem in Operating Systems. It can be implemented by using shared memory approach of inter-process communication. Explain it by showing the necessary pseudocode of the producer and consumer process. 3

a) **Draw** the Gantt charts and **calculate** the average waiting time for the following processes using the Round-Robin, and Preemptive shortest job first and Priority scheduling algorithm. Here, time quantum = 4 ms. 3x3=9

Table 1: Workload distribution of question (4.a)

Process	Arrival Time	Burst Time	Priority
P1	0	20	3
P2	1	25	2
P3	2	12	6
P4	3	13	5
P5	4	16	4
P6	6	30	1