

Serial No:

**Final Term Exam**  
**Spring Semester 2020**

**Max Time: 3 Hour**

**Max Marks: 85**

Exam Weight (Out of 100). **50**

## **CS 220 Operating Systems**

Monday, July 06, 2020

### **Course Instructor**

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Mr. Rizwan ul Haq,

Ms. Nasreen Akhtar

_____	_____
Roll No	Section

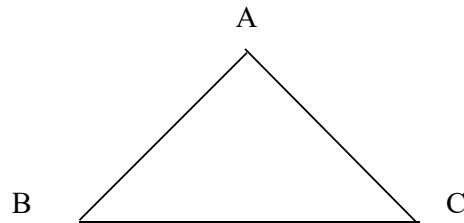
### **Guidelines for Submission:**

1. You should submit only one PDF document and **all text should be handwritten on white clean paper sheet**. Equations, figures can be taken as pictures (all figures/equations can be pasted as images inside that document).
2. You must submit your solution before due time via **Google Classroom**. Submissions submitted after the due time shall not be considered.
3. If you don't finish every part of a question, don't worry! You can still submit what you've done to get marks based on your efforts.
4. In case of copied or plagiarized solutions in exam Or If a student provided help to another student during exam both will be awarded **"F"** grade and it will affect the student CGPA.
5. Viva of any student can be conducted by the instructor after conducting an online exam in case of any doubt.
6. This document should be submitted through LMS (**Google Classroom**). But in worst case, you can email it to your Instructor within the deadline (before 01:00 PM).
7. Only **Single PDF** file will be accepted. Name the file as **"Roll No\_Section\_Name.pdf"**. e. g. 18f1111\_8A\_Ali-Ahmad.pdf and upload on Google Classroom well before the deadline. Late submission will not be accepted. Naming the file in the correct format and writing your Complete Name, Roll No. and Section on the **First Page** of your solution will earn you 2 bonus marks.

## Question No. 1

(35 Points)

1. Semaphore can be used to express scheduling constraint between activities performed by different threads. Consider the below diagram denoting the dependencies between A, B, C, which are executed by three different threads. Complete the program below to ensure these constraints (10 Points)



Declare any semaphore(s) needed  
Be sure how to initialize them

```

Static void * thread _A(void * _){
printf("A\n");
// declared desire function here

}
  
```

```

Static void * thread _B(void * _){

printf("B\n");

}
  
```

```

Static void * thread _C(void * _){

printf("C\n");
}
  
```

```

int main()
{

pthread_t t(N);
pthread_create(t+0,NULL,thread _C, NULL);
pthread_create(t+1,NULL,thread _B, NULL);
pthread_create(t+2,NULL,thread _A, NULL);
PTHREAD_EXIT(0);
}
  
```

2. How multithreaded hardware help to minimize memory stall. State your answer with diagram. (5 Points)
3. Consider the following program of producer and consumer and answer the following questions: (15 Points)

<pre> e buffer [BUFFER_SIZE];  int=0;    //counter variable         </pre>	
<p><b><u>Producer Code</u></b></p> <pre> =_____ ;  while(true){      (counter==_____);      buffer[in]=nextData;      in=(in+1)%BUFFER_SIZE;      counter++;         </pre>	<p><b><u>Consumer Code</u></b></p> <pre> =_____ ;  while(true){      (counter==_____);      consume=Buffer[out];      out=(out+1)%BUFFER_SIZE;      counter--;         </pre>

- a) Complete the code and also find the value for **in** and **out** so that logics of solution is correct. (Note: The code is intentionally make hidden) (4 Points)
  - b) What is the roll of **counter** variable? (2 Points)
  - c) Give an example sequence of execution in which the above solution fail to work correctly. (4 Points)
  - d) Provide solution using semaphore so that the solution will never fail to work correctly (5 Points)
4. Explain concurrency and parallelism also define pros and cons of each. (5 Points)

## Question No. 2

(25 Points)

1. Earliest deadline first scheduling is implemented in real-time operating systems. Show the scheduling of processes in the below mentioned table according to the earliest deadline first algorithms. Clearly draw the timeline showing the scheduling of processes. Mention if the processes can be scheduled or someone will miss its deadline. (5 Points)

Process	processing time (t)	deadline (d)	Period (p)
P1	15	Start of next period	30
P2	25	Start of next period	55

**Hint:** Draw the timeline up to 150.

2. Google chrome creates a new process instead of a separate thread for each separate tab we open. Each plugin also runs as a separate process rather than a separate thread. What is the benefit of it and what is this approach's drawback? (5 Points)
3. Answer the following (5+10 = 15 Points)
  - a) Suppose a system with average page page-fault service time of 6 milliseconds and a memory access time of 150 nanoseconds. Calculate its effective access time where the probability of page fault is 20%.
  - b) Consider the following page reference string  
7, 5, 2, 0, 2, 3, 5, 4, 6, 5, 7, 1, 2, 4, 6, 7, 1, 2, 1, 0  
Assuming demand paging with three frames, how many page faults would occur for the following replacement algorithms? Clearly show the status of frames for each page reference.
    - LRU
    - Second chance

### Question No. 3

(10+15 = 25 Points)

1. Consider the following segment table:

Segment	Base	Length
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1952	96

What are the physical addresses for the following logical addresses?

- i. <0, 513>  
\_\_\_\_\_
- ii. <1, 13>  
\_\_\_\_\_
- iii. <2, 300>  
\_\_\_\_\_

iv.  $\langle 3, 400 \rangle$

v.  $\langle 4, 112 \rangle$

---

2. Consider the following snapshot of a system:

	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
<b>P<sub>0</sub></b>	0	0	1	2	0	0	1	2	1	5	2	0
<b>P<sub>1</sub></b>	1	0	0	0	1	7	5	0				
<b>P<sub>2</sub></b>	1	3	5	4	2	3	5	6				
<b>P<sub>3</sub></b>	0	6	3	2	0	6	5	2				
<b>P<sub>4</sub></b>	0	0	1	4	0	6	5	6				

Answer the following questions using the Banker's Algorithm:

a) What is the content of the matrix Need?

	Need			
	A	B	C	D
<b>P<sub>0</sub></b>				
<b>P<sub>1</sub></b>				
<b>P<sub>2</sub></b>				
<b>P<sub>3</sub></b>				
<b>P<sub>4</sub></b>				

b) Is the system in a safe state?

c) If a request from process P1 arrives for (0, 4, 2, 0), can the request be granted immediately?