COMSATS University Islamabad, Lahore Campus
Block–C, Department of Computer Science
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Final Examination – Semester Spring 2023

Course Title:	Operating Systems				Course Code:	CSC322	Credit Hours: 3(2,1)
Course Instructor/s:	Nadeem Ghafoor Chaudhry, Tayyab Wahab Awan, M Mudassar, Rehan Raza				Program Name:	BS-SE	
Semester:	5th	Batch:	SP21-BSE & BCS	Section:	All sections & Rep	Date:	Friday, June 16th 2023
Time Allowed:	**3 Hours**				**Maximum Marks:**		**100**
Student's Name					Reg. No.		

Important Instructions / Guidelines:

- Attempt all questions.
- Do not write anything other than your name and registration number on question paper.
- Do not give multiple answers for any question. Clearly cross out what you do not want me to read.
- Give brief but to the point answers, length of your answer is not a good predictor of your expected marks.

Q1) [CLO1, 4] <Understanding> [5*3=15 marks]

a) Imagine you are team lead of a team tasked with developing new software. The source code is divided into several modules. You must decide which modules should be made into static libraries and which ones into dynamic libraries. Present your arguments for each.

b) Given initial free memory blocks of 300KiB, 200KiB, and 250KiB (in that order), show how first-fit, best-fit, and worst-fit would place blocks of size 100KiB, 150KiB, 200KiB, 200KiB, and 100KiB, requested in that order. Stop the sequence of requests if one cannot be satisfied and clearly mention which request is responsible for this stoppage.

c) Argue for bigger or smaller page size based upon following three criteria:

i. Page Table
ii. Segment Table
iii. TLB

Q2) [CLO3] <Analyzing> [3*3=9 marks]

Consider the following string of page references:

7	4	0	10	8	7	9	4	9	6	8	2	8	0	5	2	8	8	3	4

Imagine you have four frames calculate page faults for each of the following algorithms.

a) Optimal
b) LRU
c) FIFO

Q3) [CLO3] <Analyzing> [2*5=10 marks]

Imagine a 10-bit system which uses Segmentation with Paging such that the virtual address is broken down into three parts. The high end two bits are used to refer to segment number, the low order four bits are used for offset within each page and the remaining middle four bits are used for page number. Figure given below shows the current situation of the system. Your job is to translate the five virtual addresses into physical addresses if the virtual address is valid or indicate if it is invalid and provide reason why do you think it is invalid. All figures are in binary and your answer should also be in a ten-bit binary. Note that a NULL entry indicates that it does not exist.

Segment Table
0000000000
NULL
1010101010
NULL

a) 0000001010
b) 0000000101
c) 0111111111
d) 1000001010
e)1000011010

	RAM
0000000000	0000000101
1010101010	0000000100
	0000000111
1111111111	

Q4) [CLO2] < Analyzing > [2*3=6 marks]

a) If you must develop client/server application, would you prefer developing multi-threaded server or a multi-process server. Give reasons for your choice.

b) What is a thread and what are its benefits?

Q5) [CLO2] <Analyzing> [2*5=10 marks]

Given a system with several processes along with their burst time and arrival time:

Process	Burst Time	Arrival Time
P0	13	0
P1	9	2
P2	11	6
P3	3	9

(a) Using Round Robin algorithm, draw the Gantt chart and find the average waiting time. (Time slice = 4)

(b) For the given table in (a), using pre-emptive priority scheduling, draw the Gantt chart and find average turnaround time. The priority of a process is calculated using the formula: priority = int (0.6*burst time + 0.4*arrival time). (Note: Higher the number, lower the priority).

Q6) [CLO2] <Analyzing> [2*5=10 marks]

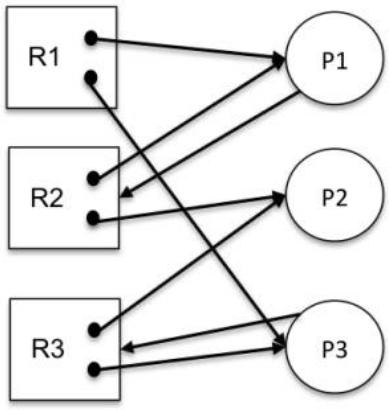
Consider a system with five processes, P0, P1, P2, P3, and P4, and three resource types, A, B, and C. The current state of the system is represented in the table below:

Processes	Maximum Need			Allocation			Available		
	A	B	C	A	B	C	A	B	C
P0	4	3	3	1	1	2	2	1	0
P1	3	2	2	2	1	2			
P2	9	0	2	4	0	1			
P3	7	5	3	0	2	0			
P4	1	1	2	1	1	2			

a) Using the banker's algorithm, calculate the values of the need and available matrices. Determine whether the system is currently in a safe state or an unsafe state.

b) Suppose Process P2 requests (1, 0, 1) resources. Will the request be granted immediately? Explain your answer, a simple YES/NO answer is not sufficient.

Q7) [CLO2] <Analyzing> [3*5=15 marks]
Consider the following resource allocation graph, and answer the below-mentioned questions:



a) Does the above allocation graph contain a deadlock? Show the steps/procedure that you took to reach your conclusion, a simple YES/NO answer is not sufficient.
b) Assume now that P2 also demands resource R1. Will this demand put the system into a deadlock? Show the steps/procedure that you took to reach your conclusion, a simple YES/NO answer is not sufficient.
c) Add to the original allocation graph an additional process P4 that demands an instance of R1. Does the allocation graph contain a deadlock? Show the steps/procedure that you took to reach your conclusion, a simple YES/NO answer is not sufficient.

Q8) [CLO2] <Analyzing> [10 marks] Explain, what is process synchronization in operating system, why we use it, and which technique is used to synchronize the processes?

Q9) [CLO2] <Analyzing> [15 marks] Consider the dining philosophers problem. If we place all five chopsticks in the centre of the table, analyze how could we use semaphores to implement the philosophers eat () method? Be sure to declare and initialize all variables you use. Your solution should be as efficient as possible.