National University of Computer and Emerging Sciences, Lahore Campus

	Course Name:	Operating Systems	Course Code:	CS2006
	Degree Program:	BSCS	Semester:	Spring 2023
	Exam Duration:	60 Minutes	Total Marks:	45
	Paper Date:	10-April-2023	Weight	15%
	Section:	ALL Sections	Page(s):	3
	Exam Type:	Mid 2 Exam		

Student : Name:_____ **Roll No.**_____ **Section:**_____

Instruction/Notes: Attempt all questions on the given answer sheet. Clearly mention your attempted question no. with the answers on the answer sheet. Avoid unnecessarily explanation. Kindly write your information in above mentioned space. Attach this question paper with your answer sheet.

CLOs	CLO-3	CLO-2	CLO-5	
Questions	Q-1	Q-2	Q-3	Total
Total Marks	20	10	15	**45**
Marks Obtained				

Question 01: (20 points) (CLO-3)
Suppose that there is a single common room in the university. When a female student is in the common room, other female students may enter, but no male student, and vice versa. A sign with a sliding marker on the door of each common room indicates which of the three possible states it is currently in:

- Empty
- Female Student present
- Male Student present

Write the following procedures in order to synchronize the above scenario:

1) **female_student_wants_to_enter**
2) **male_student_wants_to_enter**
3) **female_student_leaves**
4) **male_student_leaves**

You may use whatever counters, semaphores and synchronization techniques you like.

Question 02: (10 points) (CLO-2)
Assuming calls to all library routines succeed. What is output of the following code?

```
void *printer(void *arg) {
  char *p = (char *) arg;
  printf("%c", *p);
  return NULL;
}

int main(int argc, char *argv[]) {
  pthread_t p[5];
  for (int i = 0; i < 5; i++) {
    char c = 'a' + i;
    pthread_create(&p[i], NULL, printer, (void *) &c);
  }
  for (int i = 0; i < 5; i++)
    pthread_join(p[i], NULL);
  return 0;
}
```

Question 03: (15 points) (CLO-5)

Consider the following snapshot of a system:

	Allocation				**Max**				**Available**			
	A	B	C	D	A	B	C	D	A	B	C	D
P_0	0	0	1	2	0	0	1	2	1	5	2	0
P_1	1	0	0	0	1	7	5	0				
P_2	1	3	5	4	2	3	5	6				
P_3	0	6	3	2	0	6	5	2				
P_4	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**?

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?

Only For Sections BCS-4F, 4G, 4H and 4J

Question 03: (15 points) (CLO-5)
Can you explain the differences between deadlock and starvation in concurrent programming? Please provide coding examples and real-world scenarios to illustrate these concepts.