

Name \_\_\_\_\_

All questions are worth 10 points. Maximum score: 80

1. Suppose you are using a shared variable named **S**, and that **S** currently has the value 12. You are running two independent processes, **P<sub>1</sub>** and **P<sub>2</sub>**, which contain the following two statements.

<b>P<sub>1</sub></b>	<b>P<sub>2</sub></b>
<b>S = S*3;</b>	<b>S = S-8;</b>

These two statements are executed once and only once. After these two processes complete, what are the possible values of **S**? Explain how each possible value could occur.

2. The following two programs have critical sections with respect to variable Q. Show how to protect these critical sections using a **TestAndSet** instruction. Don't forget to initialize your variables properly.

```
if (Q>7)
{
    Q = B + 25;
}
```

```
if (Q<30)
{
    Q = 97;
}
```

3. For deadlock prevention, we must guarantee that certain conditions cannot occur. There are five of these conditions. List them. ALSO, choose **one** of the five conditions, and explain how to prevent deadlocks by making it impossible for that condition to occur. **No lengthy explanations please!**

4. The following two programs have critical sections with respect to the variable K. Show how to protect these critical sections with semaphores. Don't forget your initializations and declarations.

```
I = 30;
while (K>0)
{
    P[I] = K % 10;
    K = K / 10;
    I--;
}
```

```
K=0;
SR=0;
if (K < X)
{
    K = K + SR + SR + 1;
    SR = SR + 1
}
```

5. Assume that the following five processes have arrived simultaneously in the order given. Using the two scheduling algorithms FCFS and SJF, draw the GANTT chart for the processes, and compute the average wait time for each scheduling algorithm.

Process	Burst Time
P0	12
P1	2
P2	9
P3	3
P4	14

6. Given the following allocation tables, is the system in a safe state? If we grant a request of (1,0,1) from P4, will the system be in a safe state? If the states are safe, show the safe sequence. Otherwise show where building the safe sequence fails.

	Has		
	A	B	C
P0	1	0	0
P1	1	0	1
P2	1	1	0
P3	0	1	1
P4	1	0	1

	Max		
	A	B	C
	4	3	3
	1	3	1
	1	2	0
	2	1	1
	1	1	1

Free		
A	B	C
0	1	0

7. Is the following system deadlocked? If not show the “safe sequence” otherwise, list the processes that are deadlocked.

	Has		
	A	B	C
P0	0	0	2
P1	1	0	1
P2	0	0	0
P3	0	0	3
P4	0	1	1

	Req		
	A	B	C
P0	0	0	0
P1	0	1	0
P2	0	0	1
P3	0	1	1
P4	1	0	0

Free		
A	B	C
0	0	0

8. Considering the following resource allocation diagram, is the following system deadlocked? Why or why not?

