

Name _____

All questions are worth 10 points. Maximum score: 70

1. Suppose you are using a shared variable named **S**. You are running two independent processes, **P₁** and **P₂**, which contain the following two unprotected statements. If **S** has the initial value of 14, what are the possible values of **S** after both statements execute, and how can these values occur?

 $S = S * 3;$ $S = S / 2;$

2. You are given the following two programs. These programs have a shared message queue, which requires mutual exclusion while it is being accessed, and a shared Count variable that is being used to determine whether the message queue is empty or full. Use semaphores to eliminate the busy wait and fix the critical section problem.

```
while (Count==0);  
Buffer[In] = Msg;  
In = (In+1)%SIZE;  
Count++;
```

```
while (Count == SIZE)  
Msg = Buffer[Out];  
Out = (Out+1)%SIZE;  
Count--;
```

3. Show how deadlock can occur using three processes, but if any one of the three is missing, deadlock will never occur.

4. Is the following system in a safe state? Suppose that Process 1 makes a request of (0,0,1). Will the system still be in a safe state if the request is granted? (Exhibit safe sequences to prove your point.)

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

		Max		
		A	B	C
P0		3	4	5
P1		2	2	2
P2		1	3	3
P3		1	1	3
P4		2	7	4

		Free		
		A	B	C
P0		0	0	1

5. Is the following system deadlocked? If Process 0 makes a request of (0,0,2), will the system now be deadlocked? Exhibit safe sequences to prove your point.

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

	Request		
	A	B	C
0	0	0	0
2	2	2	2
1	3	3	5
3	1	1	3
2	5	4	4

	Free		
	A	B	C
0	0	0	1

6. Given the following page table, translate the following addresses. Addresses are four decimal digits with the first digit representing the page number, and remaining three digits representing the offset.

0	9xxx
1	1xxx
2	2xxx
3	9xxx
4	8xxx
5	7xxx
6	4xxx
7	3xxx

Virtual	Real
9125	
3298	
0125	
3125	
7000	
6498	
0999	
5434	
1293	
8143	

- 7, Given the following 2-level hierarchical page tables, translate the following addresses. Addresses are four decimal digits, with the first digit representing the first index, the second digit representing the second index, and the last two digits representing the offset.

0	7192
1	7244
2	7396
3	7680
4	7728

7192

0	21xx
1	33xx
2	47xx
3	53xx
4	66xx

7244

0	00xx
1	01xx
2	13xx
3	17xx
4	14xx

7396

0	62xx
1	55xx
2	44xx
3	37xx
4	81xx

7680

0	09xx
1	10xx
2	32xx
3	15xx
4	18xx

7728

0	08xx
1	55xx
2	02xx
3	07xx
4	96xx

Virtual	Real
2121	
3841	
4288	
8160	
2733	
9940	
0144	
1377	
2289	
3148	