

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, **P₁** and **P₂**, which contain the following two statements. Show how to protect these statements using semaphores.

S = S+3;**S = S-8;**

2. Given the same two statements, show how to protect them using the TestAndSet instruction. Treat the TestAndSet instruction as a function, just as we did in class.

S = S+3;**S = S-8;**

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. Every mechanism for protecting critical regions (i.e. for doing process synchronization) must have three properties. What are they? Give a 1 to 2-line explanation of each.

5. 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	0	1	0
P1	1	0	0
P2	1	0	0
P3	3	2	1
P4	2	0	1

	Max		
	A	B	C
	0	2	2
	1	1	2
	3	3	1
	4	2	2
	7	2	3

Free		
A	B	C
1	0	1

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

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

	Req		
	A	B	C
	1	0	1
	0	2	2
	0	0	0
	3	1	2
	1	0	3

Free		
A	B	C
0	0	0

7. We have created a decimal machine with four-digit addresses. The first two digits are the page number, while the second two are the offset. Translate the following addresses, using the given table. If a particular virtual address cannot be translated, write “page fault” for the virtual address.

Page Table

01xx
10xx
12xx
13xx
24xx
31xx
71xx
08xx
99xx
21xx
33xx

Virtual	Real
0101	
0211	
0000	
9999	
1041	
0364	
0943	
0477	
0911	
0888	

8. We have created a decimal machine with four-digit addresses. The first two digits are the segment number, while the second two are the offset. Translate the following addresses, using the given table. If a particular virtual address cannot be translated, write “segment fault” for the virtual address.

Segment Table

0123	0012
4141	0021
1902	0040
1703	0030
2111	0091
3110	0030
2121	0099
9411	0066
6502	0044
3310	0056
4211	0087

Virtual	Real
0101	
0211	
0000	
1201	
1041	
0364	
0943	
0477	
0911	
0822	