

- List the five conditions necessary for deadlock.
- Is the following system safe?

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

	Max			
	A	B	C	D
	1	1	0	5
	4	2	0	2
	4	2	1	0
	3	3	2	1
	0	4	3	1

	Free			
	A	B	C	D
	1	2	1	2

- Is the following system deadlocked?

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

	Req			
	A	B	C	D
	1	1	0	4
	3	0	0	0
	0	0	0	0
	1	0	0	1
	0	2	1	0

	Free			
	A	B	C	D
	0	0	0	0

- Is the following system deadlocked?

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

	Req			
	A	B	C	D
	0	0	0	0
	4	1	1	0
	0	0	0	3
	0	0	0	0
	0	0	3	0

	Free			
	A	B	C	D
	0	0	0	0

5. Assume you have a decimal machine with both virtual and physical addresses consisting of 4 digits. The page number is two digits and the offset is two digits. Given the following page table, translate the given virtual addresses into real addresses. If a virtual address can't be translated, write "page fault" for the real address. The page table is 12 entries long.

Page Table

35xx
52xx
61xx
70xx
32xx
01xx
11xx
45xx
60xx
59xx
91xx
22xx

Virtual	Real
0121	
3241	
0715	
1237	
0977	
1192	
1066	
0256	
0621	
0599	

6. Translate the following real addresses into virtual addresses using the following hierarchical page table. Addresses are specified in decimal, with four digits per address. The first digit indexes the first-level table while the second indexes the second-level table. If an address can't be translated, write "Page Fault" in the real address box.

First-Level Table.	Secondary table addresses (and contents)			
	2100	1300	0400	2200
2100	13xx	61xx	13xx	81xx
1300	14xx	67xx	75xx	46xx
0400	22xx	40xx	80xx	77xx
2200	38xx	19xx	92xx	91xx

Virtual	Real
0101	
0232	
1234	
2141	
2432	
3325	
7122	
2020	
3188	
9231	

7. Assume that you have a decimal machine with segmentation being used for dynamic address translation. Addresses are four decimal digits with the first digit representing the segment number and the next three digits representing the offset. Using the following segment table, translate the following addresses.

Segment Table

3521	0450
5200	0031
6132	0931
7000	0312
3201	0120
0102	0800
1111	1000
4521	0901
6012	0100
5913	0364

Virtual	Real
0121	
3241	
2715	
9237	
6977	
4192	
8066	
7256	
1621	
5599	

8. Explain the readers and writers problem and show how to solve it with semaphores.
9. What is the convoy problem?
10. How does a monitor differ from a class?
11. Explain the three types of threading.
12. What is a condition variable, and how does it work?
13. Explain the dining philosophers problem and show how to solve it with semaphores.
14. Explain the bounded buffer problem and show how to solve it with semaphores.
15. What is the difference between a binary semaphore and a general semaphore?