第二次作业（Homework）

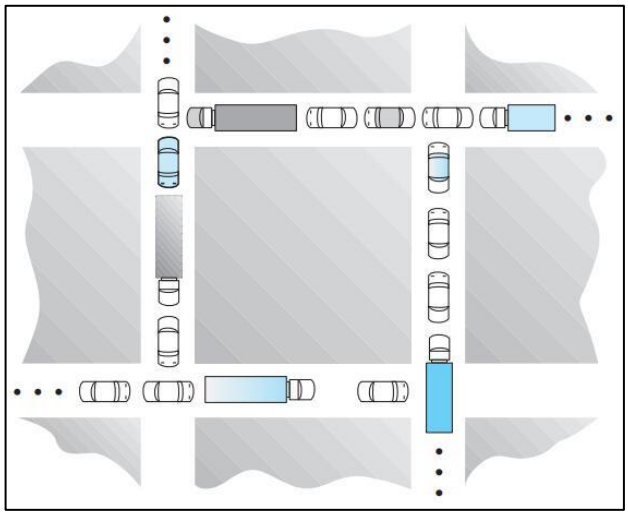
Chapter 6 Process Synchronization

1. Give the two possible solutions to the deadlock problem of DPP
   (1) Allow at most four philosophers to be sitting simultaneously at the table.
   (2) Use an asymmetric solution; that is,
      - odd philosopher: left first, and then right
      - an even philosopher: right first, and then left
2. There is a plate on the table and it could only contain one fruit. Dad Frank could put the apple on it and mum Jessica could put the orange on it. But they do such jobs by mutual exclusion. Son Tom fetches the orange only and daughter Anne fetches apple only. They do it by mutual exclusion, too. Please write down Frank, Jessica, Tom and Anne's programs by using down-up operating correctly.

   Please use semaphore.

Chapter 7 Deadlocks

1. Consider the traffic deadlock depicted in Figure below.
   a. Show that the four necessary conditions for deadlock indeed hold in this example.
   b. State a simple rule for avoiding deadlocks in this system



2. Assume that a multithreaded application uses only reader-writer locks for synchronization. Applying the four necessary conditions for deadlock, is deadlock still possible if multiple reader-writer locks are used?
3. Consider the following snapshot of a system:

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

Using the banker's algorithm, determine whether or not each of the following states is unsafe. If the state is safe, illustrate the order in which the processes may complete. Otherwise, illustrate why the state is unsafe.

a. Available = (0, 3, 0, 1)

b. Available = (1, 0, 0, 2)

4. Consider the following snapshot of a system:

	Allocation	*Max*
	A B C D	*A B C D*
T_0	1 2 0 2	4 3 1 6
T_1	0 1 1 2	2 4 2 4
T_2	1 2 4 0	3 6 5 1
T_3	1 2 0 1	2 6 2 3
T_4	1 0 0 1	3 1 1 2

Using the banker's algorithm, determine whether or not each of the following states is unsafe. If the state is safe, illustrate the order in which the threads may complete. Otherwise, illustrate why the state is unsafe.

a. Available = (2, 2, 2, 3)

b. Available = (4, 4, 1, 1)

c. Available = (3, 0, 1, 4)

d. Available = (1, 5, 2, 2)

C8 Main Memory

1. Explain the difference between internal and external fragmentation.

2. Given five memory partitions of 100 KB, 500 KB, 200 KB, 300 KB, and 600 KB (in order), how would each of the first-fit, best-fit, and worst-fit algorithms place processes of 212 KB, 417 KB, 112 KB, and 426 KB (in order)?Which algorithm makes the most efficient use of memory?

3. Consider a paging system with the page table stored in memory.

a. If a memory reference takes 200 nanoseconds, how long does a paged memory reference take?

b. If we add TLBs, and 75 percent of all page-table references are found in the TLBs, what is the effective memory reference time? (Assume that finding a page-table entry in the TLBs takes zero time, if the entry is there.)

4. Consider the following segment table:

Segment	Base	Length
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1352	96

What are the physical addresses for the following logical addresses?

a. 0,430 b. 1,10 c. 2,500 d. 3,400 e. 4,112

C9 Virtual Memory

1. Assume a program has just referenced an address in virtual memory. Describe a scenario how each of the following can occur: (If a scenario cannot occur, explain why.)

(1) TLB miss with no page fault

(2) TLB miss and page fault

(3) TLB hit and no page fault

(4) TLB hit and page fault

2. Consider the following page reference string:

7, 2, 3, 1, 2, 5, 3, 4, 6, 7, 7, 1, 0, 5, 4, 6, 2, 3, 0, 1.

Assuming demand paging with three frames, how many page faults would occur for the following replacement algorithms?

(1) LRU replacement

(2) FIFO replacement

(3) Optimal replacement

3. One job has 5 pages in a demand paging system. The sequences of page is 1, 4, 3, 1, 2, 5, 1, 4, 2, 1, 4, 5 when it is running. If the OS allocates 3 physical frames to this program, please calculate the amounts of page fault happens by using FIFO, OPT and LRU algorithm respectively.

4. What is the cause of thrashing? How does the system detect thrashing? Once it detects thrashing, what can the system do to eliminate this problem?