题号	一	二	三	四	五	六	七	八	九	总分
满分	10	12	13	15	12	13	12	13		100

一. (10 points) Select the best answer for each blank

1. In the following comments, _____ are correct.
   (1) Android is a widely used embedded operating system devoted to smart phones and tablet computers.
   (2) Microsoft Windows Phone lists Top 1 in terms of the market share among the operating systems dedicated to smart phones.
   (3) Unix has some distribution versions supporting server or mainframe computers.
   (4) Linux is a type of open source operating systems.
   (5) Windows XP is the operating system with the layered structure.
       A. (1) and (2)   B. (2) and (3)   C. (3) and (4)   D. (4) and (5)

2. In the booting procedure, when a PC computer is powered up, the chunk of codes that the CPU will at first execute is _____ .
       A. OS kernel   B. bootstrap in BIOS   C. boot block on disk   D. system programs

3. Among the following comments, only _____ are correct.
   (1) The cache is a type of non-volatile storage device; it will not lose its contents in the case of system failure.
   (2) In a system with the operating system supporting kernel-level threads, the thread is the basic unit for CPU scheduling, and the process is the basic unit for resources allocation.
   (3) PCB contains the process state, the program counter, CPU registers, and user data.
   (4) For several threads created by one process, they can share the files opened in the process.
   (5) The round robin algorithm could result in starvation.
       A. (1) and (2)   B. (3) and (4)   C. (4) and (5)   D. (2) and (4)   E. (2) and (5)

4. In the following , _____ is not one of the conditions which   should be satisfied for a good solution to critical section problem.
       A. mutual exclusion   B. fairness   C. bounded waiting   D. progress

5   A major problem for the   _____ scheduling algorithm is starvation.
       A.   Multilevel feedback queue   B. FCFS   C.   RR   D. Priority

6. Which one of the following memory management schemes suffers from external fragmentation? _____
       A. Fixed-sized partition   B. Paging   C. Segmentation   D. Segmentation with paging

7. Which one of the following memory allocation schemes can be used for allocating memory for kernel data structures?   _____
       A. paging   B. segmentation   C. fixed-size partition   D. buddy allocation

8. Which one of the following operations is to be performed not only on directory?
       A. Search a file   B. Rename a file   C. Open a file   D. Read a record from a file

9. In the following algorithms, which is a disk-scheduling algorithm ?   _____
       A. CLOCK   B. LRU   C. SSTF   D. SRTF

10. The disk free-space list is implemented as a bitmap. If the size of the disk space is 128 blocks, and each block is of 512 bytes, then_____ bytes are needed to store the bitmap.
   A.128   B.512   C.16   D.8192

二. (12 points)

As shown below, OS takes a two-level feedback-queue scheme to allocate CPU for concurrent processes. A process entering the system is at first put in queue 0.

In queue 0, the preemptive priority scheduling algorithm is used, and assuming **a small priority number has higher priority.** If a process is dispatched onto the CPU, it will be given a CPU time slice of 10 milliseconds. If it does not finish within this time, it is moved to the tail of queue 1, while running, if it is preempted, it will reenter the tail of queue 0 again.

In queue 1, FCFS scheduling algorithm is used. Processes in queue 1 are permitted to run only when there is no process in queue 0. When a process P_i in queue 1 is running on CPU and a new process P_j enters the system, P_j will preempt the CPU occupied by P_i.
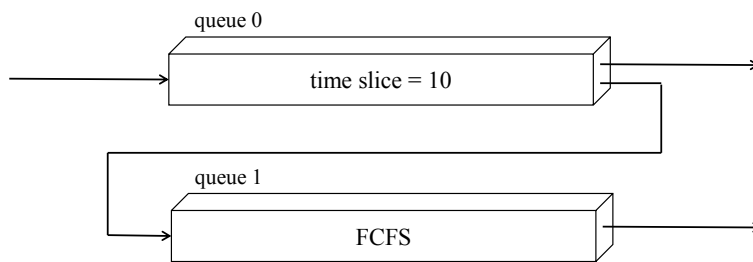
Consider the processes P_0, P_1, P_2, P_3. For $0 \leq i \leq 3$, the arrival time, the length of the CPU burst time, and the priority of each P_i are given as below.

Process	Arrival time	Burst Time	Priority
P_0	0	7	10
P_1	4	20	8
P_2	8	3	6
P_3	15	15	4

For the snapshot shown above, suppose that two-level feedback-queue scheduling is employed.

(1) Draw the Gantt chart that illustrates the execution of these processes.

(2) What are the turnaround times for the four processes?

三. (13 points)

Consider a system with four processes P_1 through P_4 and four resource types A, B, C and D. the system snapshot at time T_0 is shown as following table.

	Allocation				Request				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P_1	0	0	1	0	2	0	0	1	2	1	0	0
P_2	2	0	0	1	1	0	1	0				
P_3	0	1	2	0	2	1	0	0				
P_4	0	0	0	0	0	0	3	0				

Answer the following questions on the basis of the deadlock-detecting algorithm.

(1) What are the total numbers of the instances for the type A, B, C and D, respectively?

(2) Is the system in a deadlock state, and why?

(3) If P_2's request vector is changed into (2, 1, 0, 1), is there a deadlock in the system? And if the system is deadlocked, indicate the process/processes involved in deadlock.

四. (15 points)

A telecom company took out 100 mobile phones for sales promotion. There is only one salesman in the sales hall, so only one customer can be served at a time, and each customer is limited to buy one. The hall can accommodate 20 customers at the same time. Customer who comes to buy mobile phones will leave if he find the hall is full of customer, otherwise he will enter the hall to wait. When it's a customer's turn to buy, if the mobile phone has been sold out, then the customer leave the hall directly, otherwise, he can buy one and then leave the hall.

Please using semaphore mechanism, write out the processes to simulate the behavior of salesmen and customers.

(1) give out the definitions and initial values of semaphores, and

(2) write out the code structure of the salesman process and the customer process respectively.

五. (12 points)

We traced the execution of a process P_1 in a demand-paging system, and recorded the following logical address sequence (in decimal values) during a particular period:

0100, 0124, 0212, 0224, 0320, 0404, 0424, 0464, 0212, 0140, 0144, 0212, 0216, 0324, 0356, 0360, 0524, 0528, 0612, 0616, 0620, 0724, 0728, 0620, 0624, 0224, 0228, 0140, 0144, 0150, 0240, 0244, 0248, 0660, 0668.

Answer the following questions:

(1) Assuming the page size is 100 bytes (in decimal values), what is the reference string?

(2) Assuming four frames are allocated to this process and all frames are initially empty. How many page faults would occur for the LRU replacement algorithms?

六. (13 points)

A system using segmentation with paging has a 2^{16} bytes logical address space with 2 segments per process and a page size of 4096 bytes.

The content of the segment and page tables is specified below (all values in decimal).

Segment Table

segment	limit	pointer to page table
0	19580	pointer to page table for segment 0
1	32168	pointer to page table for segment 0

Page Table for segment 0			Page Table for segment 1	
Frame	Valid/invalid		Frame	Valid/invalid
12	1		20	1
29	1		25	0
58	0		52	1
10	1		25	1
58	1		9	1
	0		52	0
	0		25	0
	0		20	0

For the following logical addresses, indicate corresponding physical address, or if they would occur a page fault.

0, 20123

0, 12300

1, 5000

七. (12 points)

On a disk drive with 5000 cylinders, numbered from 0 to 4999, the last request served was at cylinder 125, and the head is at cylinder 143. The queue of pending request, in FIFO order, is

86　1470　913　1774　948　1509　1022　1750　130.

Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests in the queue, for the following disk scheduling algorithms?

It is required that the procedure of the arm moving to serve the requests should be illustrated by a figure.

(1) SSTF

(2) C-SCAN

(3) SCAN

八. (13 points)

Consider a file system on a disk. The size of disk blocks is 512B. The directory is organized into a tree structure, and the root directory resides in memory. Directory files are organized into linked files, and common data files are organized into indexed files.

Each directory entry has one bit to define the entry as a subdirectory or as a file, and two 2-bype fields, one holds file name and the other holds a pointer to a disk block. For a directory file, the directory name and its first disk block address are recorded. For a data file, the file name and the disk address where its FCB resides are recorded. The structure of the directory file is shown in Figure 1, and the structure of FCB is shown in Figure 2.

There are 13 pointers in the file's FCB. Each pointer (disk address) requires 2 bytes. The first 10 of these pointers point to direct blocks, i.e data blocks, the next three pointers point to indirect blocks. The first points to a single indirect block, which is an index block containing the addresses of data blocks. The second points to a double indirect block, which contains the address of index blocks, and the index blocks contain the addresses of data blocks. The last pointer contains the address of a triple indirect block.

name	address	type
A	Pointer to 1st block	directory
B	Pointer to 1st block	directory
C	Pointer to 1st block	directory
D	Pointer to FCB block	file

Figure 1 directory file

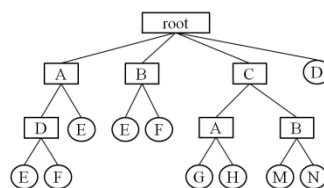|	other attributes
1	pointer
2	pointer
...	
10	pointer
11	pointer
12	pointer
13	pointer

Figure 2 FCB structure

Figure 3 directory tree

(1) Calculate the file size that can be accessed directly through FCB.

(2) Calculate the maximum address space accessible through the FCB.

(3) Suppose the directory tree of the file system is shown in Figure 3.

Now, we want to read the contents at 10KB of file M into memory, how many and which disk blocks must be read into memory?