國立交通大學試題紙

一百零三學年度第二次
博士班資格考

科目：作業系統 A

日期： 104 年 7 月 30 日 第 1 頁 共 2 頁

請" ✓" 明 ✓不可看書 可看書

* 請將答案依題號順序寫入答案卷

答題時字跡需工整，否則不予計分。Write your answers legibly; otherwise you will get zero score.

1. (12%) Consider the **single-threaded** processes in the following figure.

Process ID (PID)	Arrive Time	Burst Time
1	0	7
2	2	5
3	3	4
4	5	3

Notice:
- When a process arrives it is immediately eligible for scheduling, e.g., process 2 that arrives at time 2 can be scheduled during time unit 2.
- If a process is preempted, it is added at the tail of the ready queue.

A. Please solve this scheduling problem by **FIFO**, **RR** (time quantum = 2), **SJF (non preemptive)**. You can fill the answer as a table with the ID of the process. (2% each)

B. Consider of (A), List **response times** of individual processes for each of the scheduling algorithms. (2% each)

2. (12%) Please compare **similarities** and **differences** between multi-processes and multi-threads. And consider that you are planning to develop a server having thousands of requests from users. Which method you should use? Why?

3. (9%) There are two processes P1 and P2 that concurrently access and manipulate the same variable x (initial value is 5). Please list 3 possible outcomes of x and their execution series.

```
P1                P2
int a=x;          int b=x;
if(a>4) a++;      if(b>4) b--;
x=a;              x=b;
```

◎ 請用深黑色鋼筆或原子筆出題

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4. (9%) Please briefly describe the following terms.
   A. **Race condition.**
   B. **Deadlock.**
   C. **Starvation.**

5. (8%) How do **Deadlock-prevention** and **Deadlock-avoidance** work?
   What are the drawbacks of deadlock prevention?

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一百零三學年度第二次博士班資格考

科目:作業系統 B

日期: 103 年 7 月 30 日 第 1 頁 共 6 頁

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答題時字跡需工整，否則不予計分。Write your answers legibly; otherwise you will get zero score.

1. Given a computer running a server operating system with virtual memory support (e.g. x86_64 Ubuntu Linux). The server has 1TB free hard drive space that is available for memory page swapping. The system administrator wants to determine the appropriate memory (RAM) size for the server to balance between the cost of RAM purchasing and the performance of the server's application workload.

   For each of the following application workloads, plot the curve of page fault rate for varying memory (RAM) sizes.

   Note: *The page fault rate is defined as the ratio of (# of page faults)/(# of memory pages accessed)* for the chosen workload. *You may assume that the application workload is the only major workload on the system.*

Workload	Activity
FS1	Sequentially scan a 1 GB section of a file system file 10 times
VS1	Sequentially scan a 1 GB section of allocated virtual memory 10 times
FR1	Randomly read page-sized blocks from a 1 GB file system file 2 times
VR1	Randomly touch virtual memory pages from 1 GB virtual memory allocation 2 times
FS2	Sequentially scan a 2 GB section of a file system file 10 times
VS2	Sequentially scan a 2 GB section of allocated virtual memory 10 times
FR2	Randomly read page-sized blocks from a 2 GB file system file 2 times
VR2	Randomly touch virtual memory pages from 2 GB virtual memory allocation 2 times

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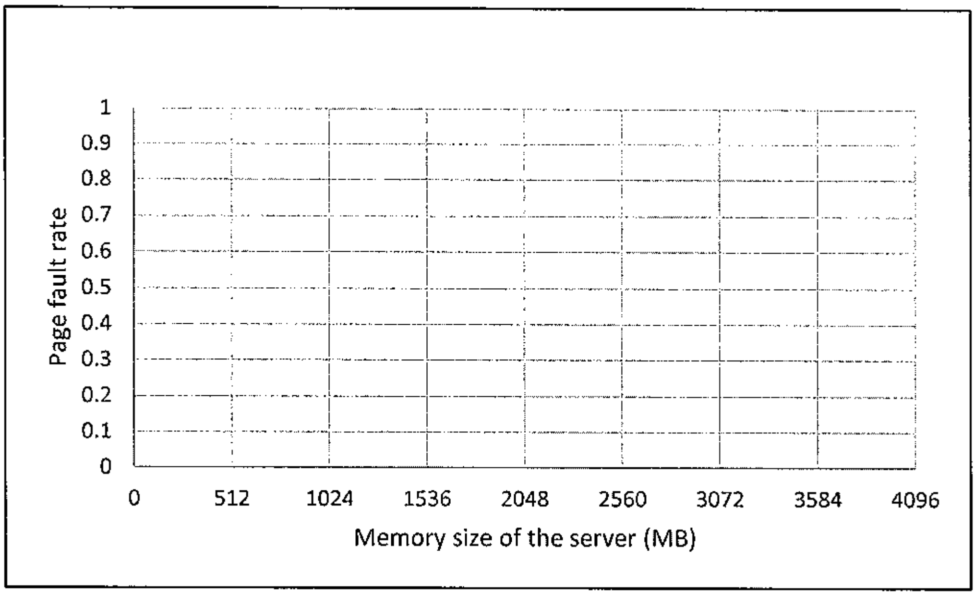
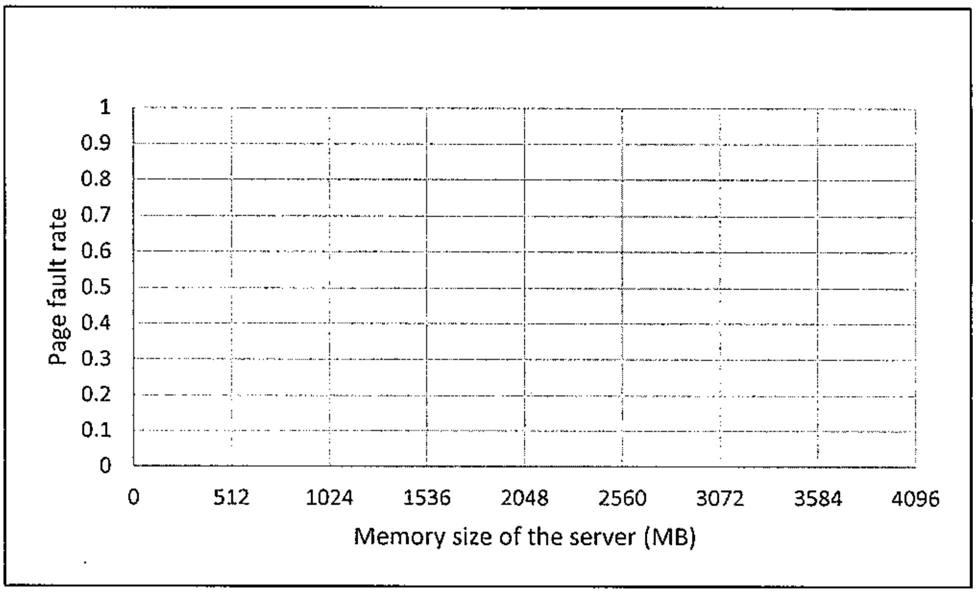


[4 pts] Workload FS1



[4 pts] Workload VS1

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一百零三學年度第二次博士班資格考

科目:作業系統 B

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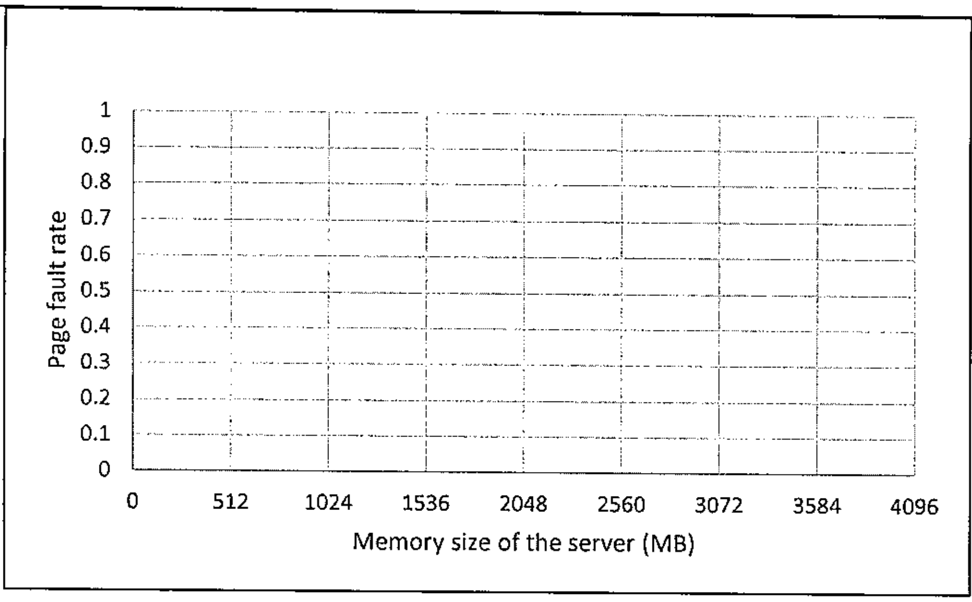
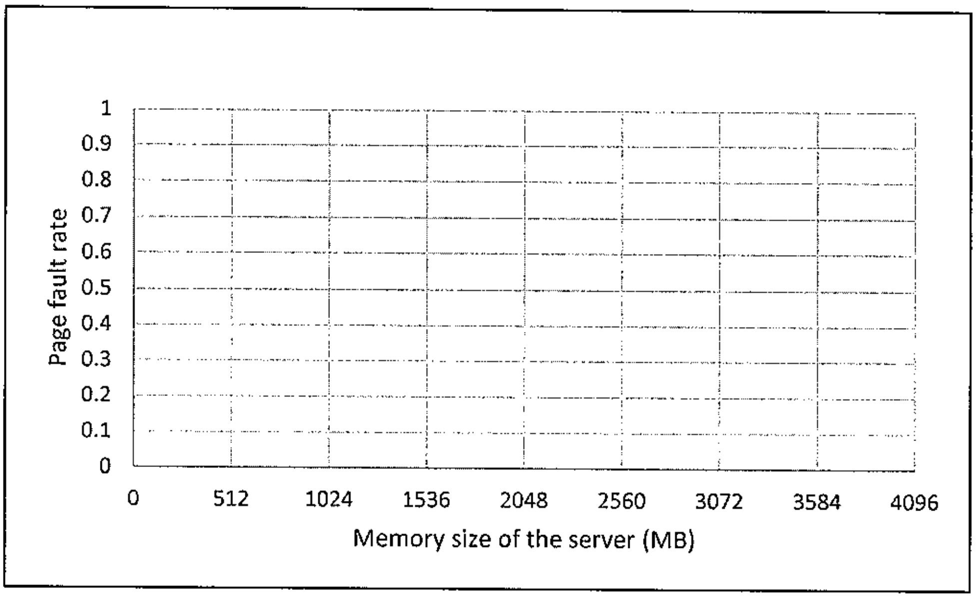


[4 pts] Workload FR1



[4 pts] Workload VR1

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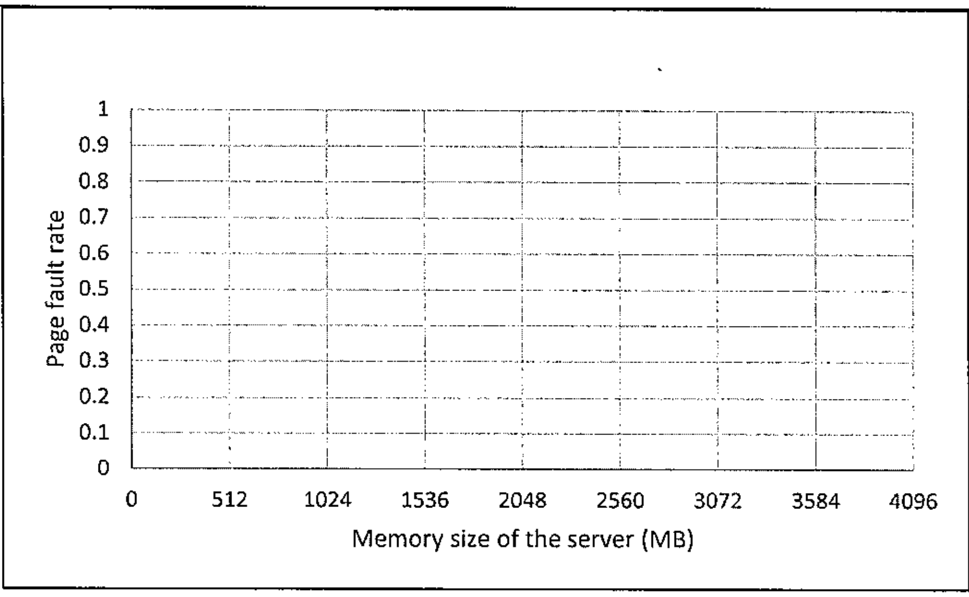
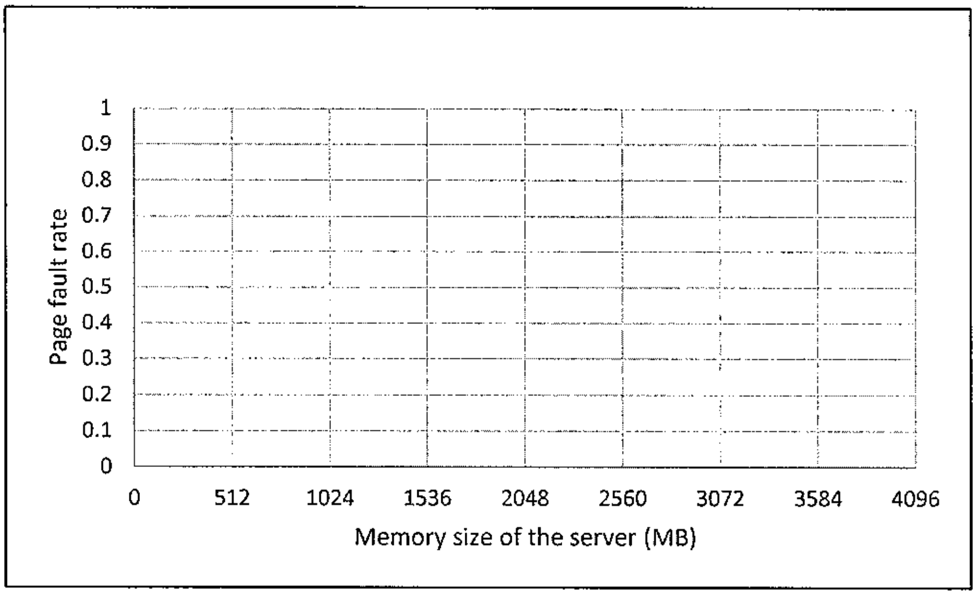
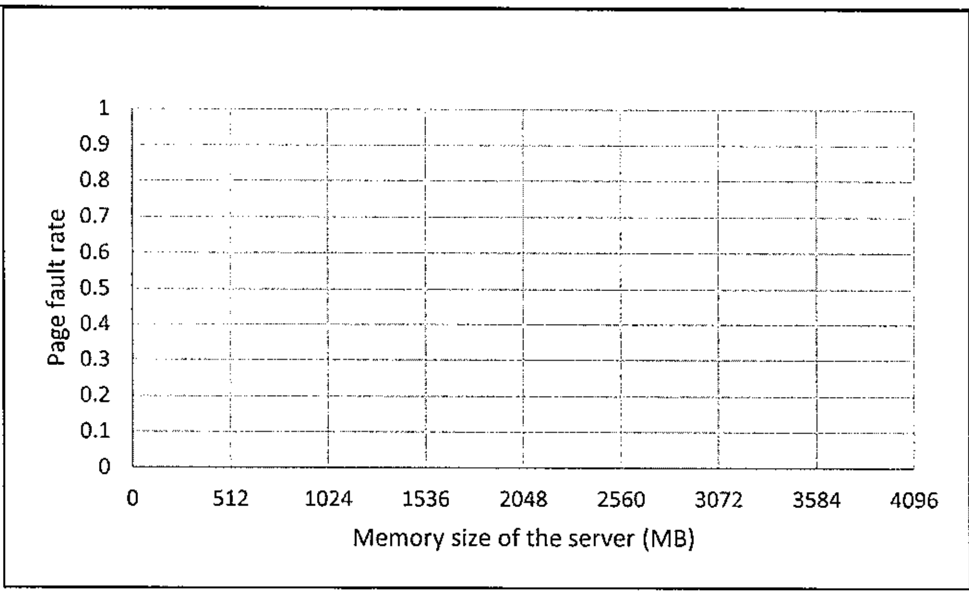
科目:作業系統 B



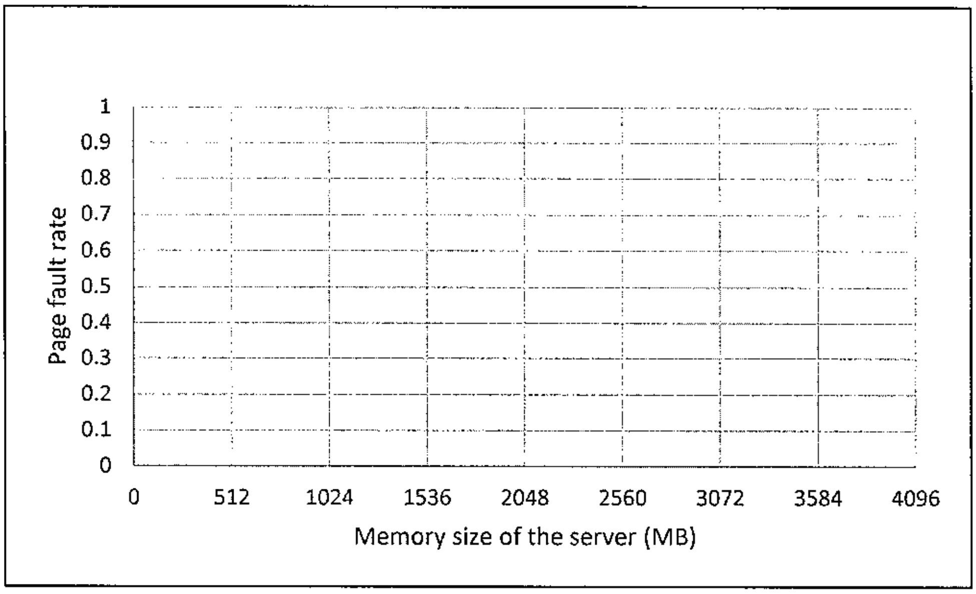
[4 pts] Workload FS2



[4 pts] Workload VS2



[4 pts] Workload FR2



[4 pts] Workload VR2

2. Assume that disks can only atomically write a sector at a time. For a file system that deletes a file by:

   Step 1: Deallocating the disk blocks used by the file data
   Step 2: Deallocating the inode of the file
   Step 3: Clearing the directory entry of the file
   Step 4: The file deletion system call returns to user
   Step 5: At some later time point, the in-memory file system cache flushes the modified directory block, the inode, the free list of disk blocks to the disk (in no particular order).

   (a). [6pts] The system crashes during file detection. Give three possible file system inconsistencies that you might see.

   (b). [6pts] Can we reduce the likelihood of file system consistencies by enforcing an order on the disk writes at Step 5? If yes, propose a write order that will reduce the likelihood of inconsistencies and state what are the inconsistencies that can be avoided by the proposed write order. If not, give the reasons.

   (c). [6pts] Can we avoid all possible inconsistencies by making the file deletion system call synchronous (i.e. Step 5 will not return until all the changes have been flushed to the disk)? If yes, give your reasons. If not, give a counter example.

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