# 資訊網路與多媒體研究所

## 資格考試科目：高等作業系統

PhD Qualification Exam
System Software (GINM)
2012 Fall

**Instructions: There are <u>five</u> questions which count 100 points in total. Each question may have several sub-questions. Please read the questions carefully before answering.**

1. (20 points) Memory management:
   A. (4 points) Please explain the different between internal fragmentation and external fragmentation.
   B. (4 points) Which one of the above two fragmentations occurs in paging systems? Please explain your answer.
   C. (4 points) Which one of the above two fragmentations occurs in pure segmentation? Please explain your answer.
   D. (4 points) If LRU page replacement is used with four page frames and eight pages, how many page faults will occur with the reference string 013727123 if the four frames are initially empty?
   E. (4 points) If Aging page replacement is used with four page frames and eight pages, how many page faults will occur with the reference string 013727123 if the four frames are initially empty?

2. (10 points) (I/O Management) RAID is proposed to enhance IO performance and improve its reliability.

   A. (6 points) Please define the following two RAID levels: RAID level 0, RAID level 1, and RAID level 4.
   B. (2 points) Which one of the above RAID levels can support disk hot swap?
   C. (2 points) Which one of the above RAID levels is more reliable than the others?

   Please explain your answer.

3. (20 points) Context switches for processes can be classified as voluntary or involuntary. Voluntary context switches for a process means that a process voluntarily gives up its CPU execution. One example for voluntary context switches is that a process makes a blocking system call. Please provide two different examples for voluntary context switches and two different examples for involuntary context switches.

4. (30 points) It has been discussed that, in the coming future, non-volatile memory will replace DRAM and mechanical disks from computing devices. In other word, non-violate memory will serve as both memory and secondary storage devices. As a result, many subsystems in operating system should be re-designed. Please discuss the following topics:
   A. (15 points) Current memory management subsystem in Operating Systems uses virtual memory to overcome the lack of physical memory. When the size of memory becomes 32GB, 128GB, or even larger, the operating system should be able to allocate physical memory to each process. Should we remove virtual memory from operating system? Please argue your answer. You receive no point for a Yes or No answer.

   B. (15 points) File systems usually manage a set of homogeneous storage devices.

It is clear that the File systems in the future should manage storage devices with different physical properties such as read/write latency, reliability, and endurance. What features should be added/removed from current file system to adapt to such changes? Please list at least two features and argue your answer. You receive no point if there is no discuss for your answer.

5. (20 points) Please answer the following questions for process management and process scheduling:
   A. (8 points) Signals could be classified as either synchronous or asynchronous signals. Please give me 1 example signal for synchronous signals and 1 example signal for asynchronous signals.
   B. (12 points) It is common to integrate priority scheduling and round-robin scheduling, in which processes of the same priority are scheduled by round-robin scheduling, and processors of higher priorities are scheduled before those of lower priorities. Please give us two ways to favor interactive processes in such an integrated scheduling. (Hint: Process priorities and time quantums could be changed.)