資訊網路與多媒體研究所

資格考試科目：高等作業系統

Instructions: There are **three** questions which count 100 points in total. Each question may have several sub-questions. Please read the questions thoroughly before answering.

1. Memory Management (35 points): the following questions assume that a single process computer with NUMA architecture.
   A. (10 points) Please describe a mechanism by which one segment could belong to the address space of two different processes.
   B. (10 points) Please explain the difference between internal and external fragmentation.
   C. (15 points) Please describe the distributed shared memory mechanism for loosed coupled distributed systems.

2. (30 points) Process management:
   A. (15 points) Race conditions are possible in many computer systems. Consider a banking system that maintains an account balance with two functions: deposit(amount) and withdraw(amount). These two functions are passed the amount that is to be deposited or withdrawn from the bank account balance. Assume that a husband and wife share a bank account. Concurrently, the husband calls the withdraw() function and the wife calls deposit(). Describe how a race condition is possible and what might be done to prevent the race condition from occurring.
   B. (15 points) A variation of the round-robin scheduler is the regressive round-robin scheduler. This scheduler assigns each process a time quantum and a priority. The initial value of a time quantum is 50 milliseconds. However, every time a process has been allocated the CPU and uses its entire time quantum (does not block for I/O), 10 milliseconds is added to its time quantum, and its priority level is boosted. (The time quantum for a process can be increased to a maximum of 100 milliseconds.) When a process blocks before using its entire time quantum, its time quantum is reduced by 5 milliseconds, but its priority remains the same. What type of process (CPU-bound or I/O-bound) does the regressive round-robin scheduler favor? Explain.
3. (35 points) The following questions are related to distributed file systems.
   A. (10 points) Please describe the major difference between networked file systems and distributed file systems, in terms of system architecture, scalability, reliability, and robustness.
   B. (10 points) Please describe the difference between replicated files and cached files on networked file systems.
   C. (15 points) Please describe the stateless servers and give an example of accessing stateless file servers.