國立台灣科技大學九十六學年度碩士班招生試題

系所組別： 資訊工程系碩士班

科　　目： 作業系統

總分 100 分。

1. 選擇題，每小題 4 分，全對共 52 分。選擇題務必於答案卷內依序作答，否則不予計分。例如，若你覺得第 a 小題至第 e 小題的空格應該分別填入 disabled、trap、job queue、ready queue、device queue，則你應該在答案卷內寫

   a. (17)　　b. (18)　　c. (19)　　d. (20)　　e. (21)

You are given a pool of keywords:

(1) cascading, (2) vectored interrupt system, (3) interrupt, (4) message passing, (5) pull,
(6) push, (7) system, (8) kernel, (9) microkernel, (10) system calls,
(11) virtual machine, (12) scheduler, (13) controller, (14) polling, (15) bootstrap,
(16) symmetric multithreading, (17) disabled, (18) trap, (19) job queue, (20) ready queue,
(21) device queue, (22) device driver, (23) device controller, (24) kernels, (25) context switch,
(26) program counter, (27) I/O-bound process, (28) CPU-bound process, (29) direct memory access,
(30) interrupt vectors, (31) privileged, (32) cooperating, (33) independent, (34) base register,
(35) index register, (36) user threads, (37) kernel threads, (38) FCFS, (39) SJF, (40) priority,
(41) dispatcher, (42) systems

Fill in each of the blanks below with the most suitable keyword from the pool. If you think the most suitable keyword for a blank should be capitalized, but the keyword in the pool is not capitalized, you can assume that the keyword is capitalized.

a. On most computer systems, a small piece of code known as the _____ program locates the kernel, loads it into main memory, and starts its execution.
b. Operating systems provide a number of services. At the lowest level, _____ allow a running program to make requests from the operating system directly.
c. A disk that has a boot partition is called a _____ disk.
d. Since an operating system is large, modularity is important. Designing a system as a sequence of layers or using a _____ is considered a good technique.
e. The list of processes waiting for a particular I/O device is called a _____.
f. When a _____ occurs, the kernel saves the context of the old process in its PCB and loads the saved context of the new process scheduled to run.
g. If a process terminates, then all its children must also be terminated. This phenomenon is referred to as _____ termination.
h. A process is _____ if it can affect or be affected by the other processes executing in the system.

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i. There are two fundamental models of interprocess communication: shared memory and _____.

j. In order to have memory protection, we use two registers that determine the range of legal addresses a program may access. The _____ holds the smallest legal physical memory address.

k. On SMP systems, it is important to keep the workload balanced among all processors. There are two general approaches to load balancing. _____ migration occurs when an idle processor gets a waiting task from a busy processor.

l. _____ is a feature provided in hardware. The idea behind it is to create multiple logical processors on the same physical processor, presenting a view of several logical processors to the operating system, even on a system with only a single physical processor.

m. If the time quantum is too large, round-robin scheduling degenerates to _____ scheduling.

2. Consider a system running ten I/O-bound tasks and one CPU-bound task. Assume that each I/O-bound task issues an I/O operation once for every msec of CPU computing and that each I/O operation takes 10 msec to complete. Also assume that the context switching overhead is 0.1 msec and that all processes are long-running tasks. What is the CPU utilization for a round-robin scheduler when the time quantum is 1 msec? (8%)

3. How long does it take to load a 64-KB program from a disk whose average seek time is 5 msec, whose average rotational delay is 8 msec, and whose tracks hold 32 KB for a 4-KB page size? Note that some transfer time is also needed. The pages are spread randomly around the disk and the number of cylinders is so large that the chance of two pages being on the same cylinder is negligible. (10%)

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4. A solution to the critical-section problem must satisfy the three requirements: mutual exclusion, progress, and bounded waiting. The following program segment is designed with a hardware instruction, Swap( ), and is tried to solve the critical-section problem.
   (a) Can the requirement "mutual exclusion" be satisfied? If not, what is the bug that must be fixed? (5%)
   (b) Suppose that "mutual exclusion" is satisfied either by fixing bugs or by no need. Can the requirements, "progress" and "bounded waiting" be satisfied? (5%)

```
do {
   key = TRUE;
   while (lock == TRUE)  Swap(&key, &lock);
       // critical section
   lock = FALSE;
       // remainder section
} while (TRUE);
```

5. In a multi-threaded application program, synchronization objects, e.g. semaphores, are usually used to synchronize the execution of the threads. In addition, critical sections are protected by synchronization objects and cannot be preempted. Therefore, deadlock is possible to occur.
   (a) To prevent deadlock to occur, which one of the four necessary conditions for deadlock can be ensured to not hold? (5%)
   (b) How to implement that the necessary condition you select has no chance to hold? (5%)

6. The three commonly discussed disk space allocation methods are "contiguous allocation", "linked allocation", and "indexed allocation".
   (a) Which one cannot support direct accessing of a specified file block? (4%)
   (b) Which one's reliability is worst? (3%)
   (c) Which one has the problem of external fragmentation? (3%)