

考生注意: 1. 依次序作答, 只要標明題號, 不必抄題。

2. 答案必須寫在答案卷上, 否則不予計分, 並限以藍黑色筆作答。

3. 試題隨卷繳回。(餘請詳閱試場規則)

1. (20%) Discuss the functional similarities and differences between a GPOS (General Purpose Operating System) and an ERTOS (Embedded Real-Time Operating System).
2. (20%) In an OS using preemptive priority-based scheduling, priority inversion and deadlock problem may occur. Answer the following questions:
  - (a) Describe deadlock prevention methods. (10%)
  - (b) Discuss why priority inversion may be unbounded and how to deal with priority inversion. (10%)
3. (20%) How are threads different from processes in resource utilization and context switching?
4. (20%) Answer the following questions regarding to memory management:
  - (a) Assume a computer with 48-bit virtual address and 32-bit physical address uses one-level paging scheme. Page size is 4 K bytes and page table entry is 4 bytes. What is the page table size needed for this paging system? (5%)
  - (b) In a paging system with three-level page tables, suppose hit ratio is 95% and it takes 10 ns to search the TLB and 60 ns to access memory. What is the effective memory access time? (5%)
  - (c) Assume a computer with 32-bit virtual address and 32-bit physical address uses two-level paging scheme. Virtual addresses are split into a 10-bit top-level page table field, a 10-bit second-level page table field, and an offset. Page size is 4 K bytes and page table entry is 4 bytes. Assume an OS maps physical memory 16M bytes to virtual address space ranging from 0 to 16M bytes with one-to-one virtual-to-physical page mapping. How many page table entries should be set up for this mapping? (10%)
5. (10%)
  - (a) The MS-DOS FAT-16 table contains 64K entries. What would the largest MS-DOS file have if all disk blocks are 2-K bytes? (5%)
  - (b) Consider an UNIX-like file system using i-node scheme. What is the maximum file size if an i-node contains 10 direct entries, and one single, double, and triple indirect entry each? Assume each indirect block contains 10 entries and all disk blocks are 4 K bytes. (5%)
6. (10%) Suppose the dining-philosophers monitor is described below. Determine if it is correct. Explain your answer. (Note: the original "hungry" state is eliminated.)

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3. 試題隨卷繳回。(餘詳詳閱試場規則)

```
monitor dining-philosophers /
{
    enum {thinking, eating} state[5];
    condition self[5];

    void pickup(int i)
    {
        test(i);
        if (state[i] != eating)
            self[i].wait();
    }
    void putdown(int i)
    {
        state[i] = thinking;
        test((i+4) % 5);
        test((i+1) % 5);
    }
    void test(int i)
    {
        if ((state[(i+4) % 5] != eating) &&
            (state[(i+1) % 5] != eating)) {
            state[i] = eating;
            self[i].signal();
        }
    }
    void init()
    {
        for (int i = 0; i < 5; i++)
            state[i] = thinking;
    }
} //end of monitor
```