國立中山大學資訊工程學系

１００學年度第２學期博士班資格考試　作業系統

INSTRUCTIONS: *If any question is unclear or you believe some assumptions need to be made, state your assumptions clearly at the beginning of your answer.*

1. (20%) What would be the output of the following C program? (*Note that the line numbers are for references only.*)

```
1  #include <stdio.h>
2  #include <unistd.h>
3  #include <sys/types.h>
4  #include <sys/wait.h>
5
6  int main()
7  {
8      int status;
9      int fd[2];
10     pipe(fd);
11     pid_t pid = fork();
12     if (pid > 0) {
13         close(fd[1]);
14         close(0);
15         dup(fd[0]);
16         close(fd[0]);
17         waitpid(-1, &status, 0);
18     }
19     else if (pid == 0) {
20         close(fd[0]);
21         close(1);
22         dup(fd[1]);
23         close(fd[1]);
24         execl("/bin/echo", "echo", "nice", "to", "meet", "you", (void*) 0);
25     }
26     else {
27         return 1;
28     }
29     return 0;
30 }
```

2. Given an i-node with eight direct blocks and three levels of indirect blocks and assuming that the sizes of a pointer and a block are, respectively, 8 bytes and 4 Kbytes, answer the following questions.
   (a) (10%) What would be the size of the smallest file allowed in bytes?
   (b) (10%) What would be the size of the largest file allowed in bytes?
3. Disk requests come in to the driver for cylinders 10, 22, 20, 2, 40, 6, and 38, in that order. A seek takes 5 msec per cylinder moved. How much seek time is needed for
   (a) (10%) Closest cylinder next, and
   (b) (10%) Elevator algorithm (initially moving upward).

   In all cases, the arm is initially at cylinder 20.
4. Assume a page reference string for a process with m frames (initially all empty). The page reference string has length p with n distinct page numbers occurring in it. For any page-replacement algorithms,
   (a) (10%) What is a lower bound on the number of page faults? **justify your answer for full credit.**
   (b) (10%) What is an upper bound on the number of page faults? **justify your answer for full credit.**

5. (10%) A computer has six tape drives, with n processes competing for them. Each process may need two drives. For which values of n is the system deadlock free?

6. (10%) A small computer has 8 page frames, each containing a page. The page frames contain virtual pages A, C, G, H, B, L, N, and D in that order. Their respective load times were 18, 23, 5, 7, 32, 19, 3, and 8. Their reference bits are 1, 0, 1, 1, 0, 1, 1, and 0 and their modified bits are 1, 1, 1, 0, 0, 0, 1, and 1, respectively. Which page will the clock page replacement algorithm replace?