

國立中山大學 110 學年度 碩士暨碩士專班招生考試試題

科目名稱：作業系統與資料結構【資工系碩士班甲組】

—作答注意事項—

考試時間：100 分鐘

- 考試開始鈴響前不得翻閱試題，並不得書寫、劃記、作答。請先檢查答案卷（卡）之應考證號碼、桌角號碼、應試科目是否正確，如有不同立即請監試人員處理。
- 答案卷限用藍、黑色筆(含鉛筆)書寫、繪圖或標示，可攜帶橡皮擦、無色透明無文字墊板、尺規、修正液（帶）、手錶(未附計算器者)。每人每節限使用一份答案卷，不得另攜帶紙張，請衡酌作答。
- 答案卡請以 2B 鉛筆劃記，不可使用修正液（帶）塗改，未使用 2B 鉛筆、劃記太輕或污損致光學閱讀機無法辨識答案者，其後果由考生自行負擔。
- 答案卷（卡）應保持清潔完整，不得折疊、破壞或塗改應考證號碼及條碼，亦不得書寫考生姓名、應考證號碼或與答案無關之任何文字或符號。
- 可否使用計算機請依試題資訊內標註為準，如「可以」使用，廠牌、功能不拘，唯不得攜帶具有通訊、記憶或收發等功能或其他有礙試場安寧、考試公平之各類器材、物品（如鬧鈴、行動電話、電子字典等）入場。
- 試題及答案卷（卡）請務必繳回，未繳回者該科成績以零分計算。
- 試題採雙面列印，考生應注意試題頁數確實作答。
- 違規者依本校招生考試試場規則及違規處理辦法處理。

國立中山大學 110 學年度碩士暨碩士專班招生考試試題

科目名稱：作業系統與資料結構【資工系碩士班甲組】

題號：434003

※本科目依簡章規定「不可以」使用計算機(問答申論題)

共 2 頁第 1 頁

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. (10%) What would be the output of the following C program? (Note that the line numbers are for reference only.)

```
1 #include <stdio.h>
2 #include <unistd.h>
3 #include <sys/types.h>
4 #include <sys/wait.h>
5 int main()
6 {
7     int fd[2];
8     pipe(fd);
9     pid_t pid = fork();
10    if (pid > 0) {
11        close(fd[1]);
12        close(0);
13        dup(fd[0]);
14        close(fd[0]);
15        int status;
16        waitpid(-1, &status, 0);
17        char buf[128];
18        int n = scanf("%s", buf);
19        printf("%d:%s\n", n, buf);
20    }
21    else if (pid == 0) {
22        close(fd[0]);
23        close(1);
24        dup(fd[1]);
25        close(fd[1]);
26        execl("/bin/echo", "echo", "hello", "world!", (void*) 0);
27    }
28    else {
29        return 1;
30    }
31    return 0;
32 }
```

2. (10%) Suppose that a disk drive has 1001 cylinders, numbered from 0 to 1000. The drive is currently serving a request at cylinder 175, and the previous request was at cylinder 125. The queue of pending requests, in FIFO order, is

50, 500, 225, 825, 350, 550, 400, 600, 100.

Starting from the current head position, what is the *total distance* (in cylinders) that the disk arm moves to satisfy all the pending requests for each of the following disk scheduling algorithms?

- (a) (2%) FCFS
 - (b) (2%) LOOK
 - (c) (2%) C-LOOK
 - (d) (2%) SCAN
 - (e) (2%) C-SCAN
3. (10%) A computer whose processes have 2048 pages in their address spaces keeps its page tables in memory. The overhead required for reading a word from the page table is 500 nsec. To reduce this overhead, the computer has a TLB, which holds 32 (page, frame) pairs and can do a lookup in 50 nsec. What hit rate is needed to reduce the mean overhead to 150 nsec or less, assuming that TLB is looked up first before the page table is read?

國立中山大學 110 學年度碩士暨碩士專班招生考試試題

科目名稱：作業系統與資料結構【資工系碩士班甲組】

題號：434003

※本科目依簡章規定「不可以」使用計算機(問答申論題)

共 2 頁第 2 頁

4. (10%) Given a UNIX *i*-node with sixteen direct blocks and four levels of indirect blocks (i.e., a single, a double, a triple, and a quadruple) and assuming that the sizes of a pointer and a block are, respectively, 8 bytes and 8 Kbytes, answer the following questions.

(a) (5%) What would be the size of the smallest file allowed in bytes?

(b) (5%) What would be the size of the largest file allowed in bytes?

5. (10%) Consider the two-dimensional array *a*:

```
double a[] [] = new double[400][400];
```

where each double occupies 8 bytes and *a*[0][0] is at location 400, in a paged system with pages of size 400 bytes. A small process is in page 0 (locations 0 to 399) for manipulating the matrix; thus, every instruction fetch will be from page 0. For three page frames, how many page faults are generated by the following array initialization loops, using LRU replacement and assuming (1) page frame 0 has the process in it, (2) the other two are initially empty, and (3) the array is stored in memory row-major.

(a) (5%)

```
for (int j = 0; j < 400; j++)  
    for (int i = 0; i < 400; i++)  
        a[i][j] = 0;
```

(b) (5%)

```
for (int i = 0; i < 400; i++)  
    for (int j = 0; j < 400; j++)  
        a[i][j] = 0;
```

6. (10%) What are printed by each of the following program segments?

(a) (5%)

```
int a=48;  
printf("%d\n", (a&(-a)) >>2);
```

(b) (5%)

```
int a=68, b=34, c=25;  
printf("%d %d\n", a^a^a^b^a, (a^b^c^b^a^c^a)+17); //^:XOR
```

7. (10%) Suppose that the preorder sequence of a binary tree is ABCDEFGH, and the inorder sequence is ABDAFGHE. What is the postorder sequence of the binary tree?

8. (15%) In the hash method, suppose that a rehash function $h_i(x) = (5i + x) \bmod 13$ is applied sequentially when a new element is inserted into the hash table, but a hash collision occurs. In other words, $h_1()$ is applied for the first time; $h_2()$ is applied if a hash collision occurs; $h_3()$ is applied if a hash collision occurs again; and so on. What is the content of the hash table after the elements 35, 22, 9, 24, 16, 19, 3, are inserted sequentially into an empty hash table of size 13, indexed as 0 through 12?

9. (a) (5%) Please give the definition of an AVL binary search tree.

(b) (5%) Assume that the initial AVL tree is empty. Please draw the AVL tree after the numbers 8, 9, 6, 3 and 2 are inserted into the tree sequentially.

(c) (5%) Please draw the AVL tree after the number 5 is inserted into the above AVL obtained in (b).