

國立中山大學 113 學年度

碩士班暨碩士在職專班招生考試試題

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，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，後果由考生自負。
- 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，唯不得攜帶書籍、紙張（應考證不得做計算紙書寫）、具有通訊、記憶、傳輸或收發等功能之相關電子產品或其他有礙試場安寧、考試公平之各類器材入場。
- 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。

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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)

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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. What is printed by each of the following C program?

(a) (5%)

```
int d=48;
printf("%d \n", (d&(-d+1)) + 3); // &: bitwise AND;
```

(b) (10%)

```
int x[ ]={ 8, 5, 3, 9, 7, 4, 6, 2};
int max(int left, int right) {
    int mid=(int) (left+right)/2;        // e.g. 7/2=3, 6/2=3
    int b;
    if (left==right)
        b=x[mid];
    else {
        int c=max(left, mid);
        if (c > max(mid+1, right))
            b=c;
        else
            b=max(mid+1, right);
    }
    cout << b << endl;
    return b;
}
int main( ) {
    max(1,5);
}
```

2. (10%) A two-dimensional array N stores the nonnegative integers with the style shown in the following table. For example, $N[0][0]=0$, then $N[0][1] = 3$, $N[0][2] = 4$, $N[1][0]=2$, and so on. Please present a formula for the value stored in $N[i][j]$, expressed in terms of i and j .

0	3	4	15	16	...
1	2	5	14	17	...
8	7	6	13	18	...
9	10	11	12	19	...
24	23	22	21	20	...
...	...	...	...	...	...

3. (10%) Please indicate whether each of the following sorting algorithms is a stable sort or not: bubble sort, heap sort, quick sort, merge sort, radix sort.

4. A large block with a height of 2 units and a width of m units, denoted by $2 \times m$, can be decomposed into small pieces of two possible types: L-shape (with three units) and square (with one unit). For example, a block of 2×1 has only one decomposition method, which is decomposed into two squares. A block of 2×2 has five decomposition methods, as shown in the following figure. Let $d(m)$ represent

試題請隨卷繳回，請留意背面是否有題

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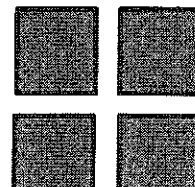
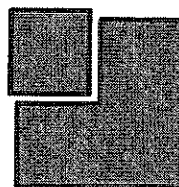
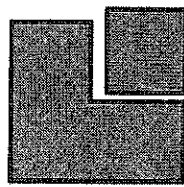
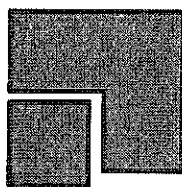
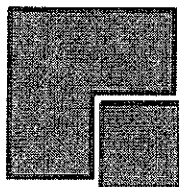
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共 2 頁第 2 頁

the number of decomposition methods for a block of $2 \times m$, $m \geq 0$. For initialization, we have $d(1)=1$ and $d(2)=5$. We also assume that $d(0)=1$.

(a) (5%) What is the value of $d(3)$?

(b) (10%) We can express $d(m)$ with a recurrence formula: $d(m) = a \times d(m-1) + b \times d(m-2) + c \times d(m-3)$, for $m \geq 4$. What are the values of a , b and c ?



5. (a) (6%) Explain the three methods to translate addresses in a real-time system.

(b) (4%) What is the difference between non-maskable and maskable interrupts?

6. (a) (6%) Given five processes arriving at time 0, processes P1, P2, P3, P4, and P5 have burst times of 10, 1, 2, 1, and 5 and are assigned with priority of 3, 1, 3, 4, and 2, respectively. A smaller priority number indicates a higher priority. Calculate the average waiting time of processes using the round-robin (with quantum = 1), the shortest job first, and the non-preemptive priority scheduling schemes.

(b) (4%) Suppose that the memory access time is 150 nanoseconds and the average page fault time is 60,000 nanoseconds. What is the expected page fault rate to keep the effective access time for demand paging lower than 175 nanoseconds?

[Note] You need to list the calculation in your answer; otherwise, no points will be awarded.

7. (10%) For each transaction T_i in the system, we associate a unique timestamp $TS(T_i)$. Each data item Q is also associated with two timestamp values: 1) W-timestamp(Q) is the largest timestamp of any transaction that successfully executed write(Q); and 2) R-timestamp(Q) denotes the largest timestamp of any transaction that successfully executed read(Q). Please show how the timestamp ordering protocol operates to check if a non-serial schedule is conflict serializable.

[Hint] You can show how this protocol operates when transaction T_i issues read(Q) and write(Q).

8. (20%) Fill-in questions (2 points each)

(a) Each thread has a _____ to indicate the address of the next instruction to be executed.

(b) Any solution to the critical-section problem has to meet three requirements, including mutual exclusion, progress, and _____.

(c) A _____ buffer can be viewed as a cache for a page table.

(d) The _____ unit can map logical pages to physical page frames in memory.

(e) _____ means that a process is spending more time paging than executing.

(f) Any entity containing a file system is generally known as a _____.

(g) RAID level 6 employs the _____ redundancy scheme.

(h) In role-based access control, a _____ is the right to execute a system call or to use an option within that system call.

(i) AES can use key lengths of 128, _____, and 256 bits and works on 128-bit blocks.

(j) A _____ virus attempts to avoid detection by modifying parts of the system that could be used to detect it.