

國立清華大學 命題紙

95 學年度 資訊系統與應用 系(所) 乙 組碩士班入學考試

科目 計算機概論 科目代碼 2801 共 3 頁第 1 頁 *請在【答案卷卡】內作答

- 1 (10%) The Capability Maturity Model for Software (CMM or SW-CMM) was successfully developed by the Software Engineering Institute of Carnegie Mellon University in 1987. Now CMM is considered to be an industrial standard for improving software processes. It is composed of five levels in total according to the degree of maturity. What are the names of the five levels of the CMM? In your own words, briefly describe each.

- 2 (10%) Direct memory access (DMA) is one of the techniques for data transfer between memory and I/O peripherals.
 - (a) A DMA read transfers data from _____ to _____. (2%)
 - (b) A DMA write transfers data from _____ to _____. (2%)
 - (c) State the difference between DMA-controlled I/O and interrupt-driven I/O. (6%)

- 3 (9%) In general, parameters can be classified into three modes. They can be used to: (1) pass information to a subprogram, (2) receive information from a subprogram, or (3) pass information to a subprogram where it is to be updated before being returned. Thus, what would be the effect of the *whichmode(a[element])* when the parameters are passed by (a) by value, (b) by reference, and (c) by name?

....

var *element*: integer;

a: array [1..2] of integer;

procedure *whichmode*(x: ? mode integer);

begin

a[1] := 6;

element := 2;

x := *x* + 3

end;

begin

a[1] := 1; *a*[2] := 2;

element := 1;

whichmode(*a*[*element*]);

.....

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Mechanism	Results		
	a[1]	a[2]	element
Call by value			
Call by reference			
Call by name			

- 4 (6%) A Software inspection is a formal verification technique in which software life-cycle work products are examined in detail by a group of peers for the explicit purpose of detecting and identifying errors. As a member of the inspection team, you could save the programmers a lot of testing time by finding the errors during the inspection. The following program has three separate errors, each of which would cause an infinite loop. Please find the errors and explain why they need to be corrected.

```
void Increment(int);
int main()
{
    int count = 1;
    while(count < 10)
        cout << " The number after " << count; /* Function Increment
        Increment(count);                      adds 1 to count */
        cout << " is " << count << endl;
    return 0;
}
```

5. (10%)
- (a) SRAM is an acronym for what type of device? Besides, DRAM is an acronym for what type of device? (4%)
- (b) Explain the reason why DRAM devices generally have larger capacities than SRAM ones. (6%)

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6. (10%)

- (a) Give an example of an algorithm that is (i) $O(1)$, (ii) $O(N)$. (4%)
(b) A routine to calculate the sum of the results of applying int function X to the values in array data contains the following code segment:

```
sumOfX = 0;
for (int index = 0; index < numberOfElements; index++)
    sumOfX = sumOfX + X(data[index]);
```

If the function X is $O(N)$, what is the order of the algorithm with respect to numberOfElements? (6%)

7 (6%) What is the meaning of the term *race condition*?

8 (6%) There are three different ways to traverse a tree, denoted by inorder, preorder and postorder. To uniquely determine a tree, how many (at least and exactly) tree traversal sequences are need? Please explain your reason briefly.

9 (11%) This problem is about the process synchronization. In Bakery Algorithm, the process receives a *number* before entering its critical section. Is the number unique? Please explain your answer.

10 The Tower of Hanoi problem is as follows: We are given a tower of n disks, initially stacked in increasing size on the 1st peg. We have three pegs. The objective is to transfer the entire tower to the 3rd peg, moving only one disk at a time and never put a larger one onto a smaller one.

- (a) (10%) Please write a recursive algorithm in pseudo code to solve the Tower of Hanoi problem. Please use the following variable: $D(i)$ is the disk with size i . Therefore, $D(n)$ is the disk with the largest size. $P(j)$ is the j th peg. You need to move the entire tower from $P(1)$ to $P(3)$.
(b) (12%) Assume that you have 4 pegs, you need to move the entire tower from $P(1)$ to $P(4)$. please design a recursive algorithm in pseudo code to solve the Tower of Hanoi problem with four pegs. The total moving steps in your algorithm must be as small as possible.