

國立中正大學

112 學年度碩士班招生考試

試題

[第 2 節]

科目名稱	計算機概論(含程式設計)
系所組別	資訊工程學系-乙組

—作答注意事項—

※作答前請先核對「試題」、「試卷」與「准考證」之系所組別、科目名稱是否相符。

1. 預備鈴響時即可入場，但至考試開始鈴響前，不得翻閱試題，並不得書寫、畫記、作答。
2. 考試開始鈴響時，即可開始作答；考試結束鈴響畢，應即停止作答。
3. 入場後於考試開始 40 分鐘內不得離場。
4. 全部答題均須在試卷（答案卷）作答區內完成。
5. 試卷作答限用藍色或黑色筆（含鉛筆）書寫。
6. 試題須隨試卷繳還。

國立中正大學 112 學年度碩士班招生考試試題

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本科目共 5 頁 第 1 頁

系所組別：資訊工程學系-乙組

1. (6 points) How many function calls does `a(15)` produce if we use this recursive function written in C? Please choose the correct answer and explain why.

```
int a(int n){  
    if(n == 0)  
        return 1;  
    else  
        return n * a(n-1);  
}
```

- A. 14
- B. 15
- C. 16
- D. 17

2. (5 points) What is the correct printed message of the following program fragment written in C? Please choose the correct answer and explain why.

```
int score = 2, all_num_test = 5;  
for(int num_test = 0, final_score = 0;  
    num_test < all_num_test;  
    num_test++, final_score += score){  
    printf("%d ", final_score);  
}
```

- A. 0 1 2 3 4 5
- B. 0 1 2 3 4 5 6
- C. 1 2 3 4 5
- D. 1 2 3 4 5 6

國立中正大學 112 學年度碩士班招生考試試題

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本科目共 5 頁 第 2 頁

系所組別：資訊工程學系-乙組

3. (6 points) There is a large enough array A with indices p and q, which are initialized by 0. Array A and indices p and q can only be accessed in the functions $f(x)$ and $g()$. If functions $f(x)$ and $g()$ are defined as follows. Which data structure is operated by those functions? Please choose the correct answer and explain why.

$f(x)$

- $p \leftarrow p + 1$
- $A[p] \leftarrow x$

$g()$

- $x \leftarrow A[p]$
- $p \leftarrow p - 1$
- return x

- A. Hash
- B. Heap
- C. Stack
- D. Queue

4. (8 points) Please read the following program fragment of the C programming language. If a user inputs the sequence of numbers (-1, -2, -3, 1, 2, 3), what are the values stored in variables s, g, z, and i at the end of the execution of the loop?

```
int z = 0, g = 0, s = 0, i = 0, t;
while (i < 6) {
    scanf("%d", &t);
    s = s + t;
    if (t >= 0)
        ++g;
    else
        z++;
    i += 1;
}
```

5. (6 points) Let f be the following function:

```
int f(char *s, char *t){
    char *p1, *p2;
    for(p1 = s; *p1; p1++){
        for(p2 = t; *p2; p2++){
            if(*p1 == *p2) break;
        }
        if(*p2 == '\0') break;
    }
    return p1 - s;
}
```

What is the return value of $f(\text{"abcd"}, \text{"babc"})$?

6. (6 points) Suppose that s is the following structure:

```
struct {
    double a;
    union{
        char b[4];
        double c;
        int d;
    } e;
    char f[4];
} s;
```

If char values occupy one byte, int values occupy four bytes, and double values occupy eight bytes, how much space will a C compiler allocate for s (assume that the compiler leaves no holes between members)?

7. (5 points) The following program fragments illustrate the expressions using different operators. What is the output produced by each, assuming that i , j , and k are int variables?

```
i = 5; j = 0; k = -5;
printf("%d", i && j || k);
```

國立中正大學 112 學年度碩士班招生考試試題

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本科目共 5 頁 第 4 頁

系所組別：資訊工程學系-乙組

8. (8 points) Finish the conversion listed below.

- Convert the octal value 123 to the decimal value
- Convert the binary value 111010101001 to the octal value
- Convert the hexadecimal value A4D to the octal value
- Convert the decimal value 35 to the hexadecimal value

9. (6 points) Write regular expressions for the following languages. The alphabet is {0, 1}.

- (3 points) All strings of 0's and 1's that contain the string 010.
- (3 points) All strings of 0's and 1's that begins with string 111 or 000.

10. (12 points) Explain the following terms:

- (3 points) Binary translation
- (3 points) Pseudo instruction in assembly language
- (3 points) Memory leak
- (3 points) Calling convention

11. (12 points) Consider the following two C programs.

- (3 points) Do these two programs have the same output? Why?
- (4 points) Without compiler optimizations, which program has less execution time generally? Why?
- (5 points) What are advantages and disadvantages of implementing functions as macros in C programs?

```
// Program A
#include <stdio.h>
#define func(var1, var2) \
    var1 = var1 + var2 >> 2; \
    var2 = (var1 + var2) % 10; \

int main(void)
{
    int a, b, i;
    a = 2;
    b = 4;
    for (i=0; i<4; i++) {
        func(a, b);
        printf("%d %d\n", a, b);
    }
    return 0;
}
```

```
// Program B
#include <stdio.h>
void func(int *ptr1, int *ptr2)
{
    *ptr1 = *ptr1 + *ptr2 >> 2;
    *ptr2 = (*ptr1 + *ptr2) % 10;
}

int main(void)
{
    int a, b, i;
    a = 2;
    b = 4;
    for (i=0; i<4; i++) {
        func(&a, &b);
        printf("%d %d\n", a, b);
    }
    return 0;
}
```

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本科目共 5 頁 第 5 頁

系所組別：資訊工程學系-乙組

12. (20 points) Consider the following C program, which is properly compiled and run at a 64-bit OS.

We say that the pointer variable `p1` points to `v1` after executing the statement: `p1=&v1` (line 10).

- (4 points) In line 14, which variables might the pointer variables `p1`, `p3`, `r1`, and `ptr` point to, respectively?
- (4 points) In line 18, which variables might the pointer variables `p1`, `p3`, and `r1` point to, respectively?
- (8 points) In line 22, which variables might the pointer variables `p1`, `p3`, and `r1` point to, respectively?
- (4 points) What is the output of the program?

```
1 #include <stdio.h>
2 #include <stdlib.h>
3 void func(int* ptr) {
4     printf("%d\n", sizeof(ptr));
5 }
6 void main(void) {
7     int *p1, *p2, *p3, **r1;
8     int v1, v2[100], v3;
9     int cond = rand();
10    p1 = &v1;
11    p3 = &v3;
12    r1 = &p1;
13    func(v2);
14
15    if (cond%2 == 0) {
16        *r1 = v2;
17        *p3 = 0;
18        v1 = 1;
19    } else {
20        p3 = NULL;
21    }
22    printf("%d\n", sizeof(v2));
23 }
```