

國立臺中教育大學 102 學年度研究所碩士班招生考試

計算機概論試題

適用學系：資訊工程學系碩士班

一、 選擇題 (20%，每題 2%)

Given the C program, please answer the questions as follows :

```
#include <stdio.h>

void fun1 (int x, int y, int z) {
    printf("%d, %d\n", x, y);           //*****Problem1
    printf("%d, %d\n", x||y, x&& y);    //*****Problem2
    printf("%d, %d\n", (x+y)||z, x&&(y+z)); //*****Problem3
    printf("%d, %d\n", x--, ++y);      //*****Problem4
}

void fun2 (int p, int q) {
    int x=1, y=1, z=1, t=5;
    for (int i=0; i < q; i++) {
        z=p;
        for (y=i+1; y < q; y++)
            if (z < y) t++;
    }
    printf("%d, %d\n", y, z);           //*****Problem5
    printf("%d, %d\n", p, t);         //*****Problem6
}

void fun3(int x, int y, int z){
    int *t=&z;
    do {
        (*t)+=x;
        y+=4;
    } while (y < z);
    printf("%d, %d\n", *t, y);        //*****Problem7
}
```

```

void fun4(int *p, int *q, int *r) {
    int **pp=&p, **qq=&q, **rr=&r;
    p=q;
    q=r;
    *p+=1;
    *q=*r+2;
    printf("%d, %d\n", *p, *r);  //*****Problem8

    pp=&r;
    *rr=q;
    **qq=*r+**pp;
    printf("%d, %d\n", **qq, **rr); //*****Problem9
}

void fun5( int p1, int *p2, int *p3, int a[]){
    a[0]=20;
    p1=20+1;
    *p2=20+2;
    p3=a+2;
}

int main(int argc, char* argv[])
{
    int a=1, b=2, c=3;
    int myArray[]={50, 100, 150, 200};
    fun1(1,0,1);
    fun2(3, 3);
    fun3(2, 3, 2);
    fun4(&a, &b, &c);
    fun5( myArray[1], myArray+2, &myArray[3], myArray);
    printf("%d, %d, %d, %d\n", myArray[0],
           myArray[1], myArray[2], myArray[3]);  //*****Problem10

    return 0;
}

```

1. What are the output results for problem1?

- (A) 0, 0
- (B) 0, 1
- (C) 1, 0
- (D) 1, 1

2. What are the output results for problem2?

- (A) 0, 0
- (B) 0, 1
- (C) 1, 0
- (D) 1, 1

3. What are the output results for problem3?

- (A) 0, 0
- (B) 0, 1
- (C) 1, 0
- (D) 1, 1

4. What are the output results for problem4?

- (A) 0, 0
- (B) 0, 1
- (C) 1, 0
- (D) 1, 1

5. What are the output results for problem5?

- (A) 3, 3
- (B) 1, 1
- (C) 1, 3
- (D) 3, 5

6. What are the output results for problem6?

- (A) 3, 3
- (B) 1, 1
- (C) 1, 3
- (D) 3, 5

7. What are the output results for problem7?

- (A) 7, 4
- (B) 4, 7
- (C) 2, 3
- (D) 3, 2

8. What are the output results for problem8?

- (A) 2, 3
- (B) 3, 5
- (C) 5, 3
- (D) 5, 5

9. What are the output results for problem9?

- (A) 3, 5
- (B) 5, 5
- (C) 10, 10
- (D) 6, 6

10. What are the output results for problem10?

- (A) 50, 100, 150, 200
- (B) 20, 21, 22, 22
- (C) 20, 21, 22, 200
- (D) 20, 100, 22, 200

二、 簡答題 (50% , 每題 5%)

1. Given the C program as follows, what are the output results?

```
#include <stdio.h>

void fun (int x) {
    int b=2, n=0, r=x/b;
    while (r>0) {
        r=x/b;
        n++;
        b=b*2;
        r=x/b;
    }
    n=b;
    while (n>0) {
        r =x/n;
        x=x%n;
        n=n/2;
        printf ("%d", r);
    }
}

int main() {
    int a=8;
    fun (a);
    return 1;
}
```

2. Given the C program as follows, what are the output results?

```
#include <stdio.h>
int main()
{
    const int MAX_HIGH = 5;
    int odds [MAX_HIGH][MAX_HIGH];

    // initialize array to 0
    for (int i = 0; i < MAX_HIGH; i++)
        for (int j=0; j < MAX_HIGH; j++)
            odds[i][j] = -1;

    // fill triangular array
    for (int i = 0; i < MAX_HIGH; i++)
        for (int j = 0; j <= i; j++)
            odds[i][j] = i+j;

    // print triangular array
    for (int i = 0; i < MAX_HIGH; i++) {
        for (int j = 0; j <= i; j++){
            printf("%d ", odds[i][j]);
        }
        printf("\n");
    }
    return 0;
}
```

3. What is the difference between overriding and overloading? Please briefly describe?
4. What is the waterfall model of software development life cycle? Please briefly describe?
5. Please rank the typical scale (in increasing order) of the following networking technologies. Also, please write down your reasons. (a) MAN (b) LAN (c) PAN (d) WAN
6. Which layer of the OSI reference model handle the operations of the addressing and routing? Also, please write down your reasons. (a) physical layer (b) data link layer (c) network layer (d) transport layer (e) session layer (f) presentation layer (g) application layer
7. Select the protocol(s) of the application layer of the TCP/IP reference model. Also, please write down your reasons. (a) FTP (b) DNS (c) HTTP (d) WWW (e) TCP (f) UDP (g) IP

8. Select the characteristic(s) of the circuit switching. Also, please write down your reasons. (a) call setup (b) dedicated physical path (c) packets arrive in order
9. Formulate a weighted binary code for the decimal digits, using weights: **6, 3, 2, 1**.
10. What is the binary equivalent of the decimal number **61.25**?

三、 問答題 (30%, 每題 10%) :

1. Select the benefit(s) of using multithreaded processes. Also, please write down your reasons. (a) responsiveness (b) resource sharing (c) economy (d) scalability
2. A computer has a 32-bit instruction word broken into fields as follows: opcode, 8 bits; two register fields, 7 bits each; and one immediate operand field, 10 bits.
 - (a) What is the maximum number of operations that can be specified? (4%)
 - (b) How many registers can be addressed? (3%)
 - (c) What is the range of immediate operands that can be provided, using two's complement representation? (3%)
3. Please explain the following three operand addressing modes commonly used in computer hardware instructions: *immediate addressing*, *simple (direct) addressing*, and *indirect addressing*.

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資料結構試題

適用學系：資訊工程學系碩士班

※100%，每題 10%。

1. Rewrite the following list of functions in order of increasing Big-O complexity:

$1/5$
 n^3
 $\log^2 n$
 $n \cdot 2^n$
 $n \log n$
 $\log \log n$
 $(n+1)!$
 n
 $\log n$
 $4^{\log n}$

2. Give Time Complexity Analysis of the following codes in terms of Big-Oh notation (2% for each question)

(1)

```
int K=0;
for(int i=0; i<N; i++) {
    cout <<"Hello";
    for(int j=0; j<K; j--)
        Sum++;
}
```

(2)

```
sum = 0;
for(i=1; i<n; i++)
    for(j=1; j<i*i; j++)
        for(k=1; k<j; k++)
            if (j % i == 0)
                sum++;
```

(3)

```
int i =1;
while(i<n) {
    for(int j=1; j<n; j *= 5){
        for(int k=0;k<n;k++)
            cout<<" Time Complexity Analysis";
    }
    i++;
}
```

(4)

```
for(i=1; i<n; i++) {
    if(i/2 == 0)
        for(i=1; i<n; i=i*2)
            a=i;
    else
        a=i;
}
```

(5)

```
int i =1;
while(i<N){
    for(int j=1; j<N; j *= 5){
        for(int k=0;k<N;k++)
            cout<<"Complexity Analysis";
    }
    i=i*3;
}
```

3. Please answer following questions:

(1) What is circular queue? (2%)

(2) Write down routines for inserting the elements from a circular queue implemented using arrays. (4%)

(3) Write down routines for deleting the elements from a circular queue implemented using arrays. (4%)

4. Consider the Tree in Fig. 1. Find

- (1) The degree of the tree: _____
 - (2) The depth of the tree: _____
 - (3) The siblings of the node K: _____
 - (4) The ancestors of the node L: _____
 - (5) The nodes at level 4: _____
- (2% for each question)

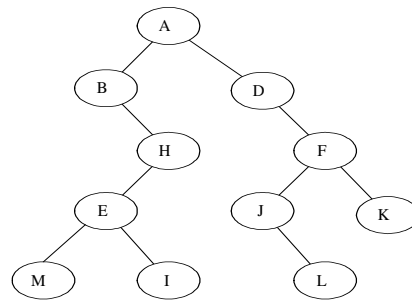


Fig. 1

5. Consider the Binary Tree in Fig. 1. Find

- (1) The preorder traversal: _____
 - (2) The inorder traversal: _____
- (5% for each question)

6. (1) What is the maximum number of nodes in a binary tree of depth k ($k \geq 1$)?

(2) What is the maximum number of nodes on level i ($i \geq 1$) of a binary tree?

(5% for each question)

7. Suppose that we have the following key values: 7, 15, 50, 5, 90, 31, 6, 2, and 40.

(1) What is the definition of MAX heap?

(2) Write out the MAX heap after each value is inserted into the heap.

(5% for each question)

8. Please indicate whether each of the following statements is True or False:

(O : upper bound, Ω : lower bound, θ : exact order) (2% for each question)

(1) $100n^2 \in O(n^2)$

(2) $2^n \in O(n^2)$

(3) $0.01n^2 \in \Omega(n^2)$

(4) $\log_3 n \in \theta(\log_2 n)$

(5) $3^n \in \theta(2^n)$

9. Given $T(n) = \begin{cases} T(n-1) + n - 1 & n > 0 \\ 0 & n = 0 \end{cases}$ where $n \in \mathbb{N}$, prove or disprove $T(n) \in \theta(n^2)$.

10. Suppose the character set is $\{a, b, s, t, k\}$ and the file to be encoded is

$\{s b b a b t b a s b k b a a s\}$.

Please identify the total number of bits required to encode the file in case of using

(1) fixed-length binary code (3%)

(2) Huffman code (7%)