

計算機概論 試題
(含程式設計)

(限用答案本作答)

1. (Computer organization, 10%) An imaginary computer has four data registers (R0 to R3), 1024 words in memory, and 16 different instructions (add, subtract, etc.). A typical instruction uses the following format:
add 565 R2.
 - (a) What is the minimum size of an instruction in bits? (5%)
 - (b) What is the size of the program counter of the computer? (5%)

2. (Computer network, 10%)
 - (a) What is the difference between TCP and UDP? (5%)
 - (b) What is the difference between frame and packet? (5%)

3. (Operation system, 10%) A multiprogramming operation system uses paging. The available memory is 60MB (byte) divided into 15 pages, each of 4MB. The first program needs 13MB. The second program needs 12MB. The third program needs 27MB.
 - (a) How many pages are unused? (5%)
 - (b) What is the total memory wasted? (5%)

4. (Algorithm, 10%) Write a recursive algorithm to find the greatest common divisor (gcd) of two integers using the definition below.

$$\text{gcd}(x, y) = \begin{cases} \text{gcd}(y, x) & \text{if } x < y \\ x & \text{if } y = 0 \\ \text{gcd}(y, x \bmod y) & \text{otherwise} \end{cases}$$

5. (Data structure, 10%) A binary tree has 10 nodes. The **inorder** and **preorder** traversal of the tree follow. Draw the tree.

Preorder : JCBADEFIGH

Inorder : ABCEDFJGIH

6. (Data compression, 15%)
 - (a) What is **Huffman** coding? (5%)
 - (b) Why is the **DCT** needed in **JPEG**? (5%)
 - (c) Encoding the following bit pattern using **run-length** encoding with **5-bit** codes: (5%)

1, eight zeros, 1, forty-five zeros, 11

7. (Security, 15%)

(a) What are the **disadvantages** of secret key encryption? (5%)

(b) Why is the RSA algorithm so powerful? (5%)

(c) Use the public key (15, 3) to encrypt the number 7. Use the private key (15, 11) to decrypt the result of the previous encryption. Draw a diagram to show the flow of information between the sender and receiver. (5%)

8. (Program design, 10%) Euler's number, e , is used as the base of natural logarithms. It can be approximated using the following formula:

$$e = 1 + 1/1! + 1/2! + 1/3! + 1/4! + 1/5! + \dots + 1/(n-1)! + 1/n!$$

Write a program that approximates e using a loop that terminates when the difference between two successive values of e differ by less than 0.0000001.

Program Design (10%). Which of the following program segments has a logical error in it? Why?

- a.

```
int **p;
int *q;
q = &p;
```
- b.

```
int **p;
int *q;
p = &q;
```
- c.

```
int **p;
int **q;
p = &q;
```
- d.

```
char c = 'A';
char **p;
char *q;
q = &c;
printf("%c", *p);
```