國立臺中教育大學 100 學年度研究所碩士班招生考試

計算機概論試題

適用學系：資訊科學學系

一、 單選題: (40%)

1. Which device can transmit information between networks using totally different communication techniques? (a) repeater, (b) router, (c) bridge, (d) hub.
2. Which layer is in charge of assigning port numbers to programs and remembering which program goes with which port? (a) physical layer, (b) network layer, (c) data link layer, (d) transport layer.
3. Which is the process of associating a symbolic name with a physical memory address? (a) synchronizing, (b) binding, (c) validating, (d) registering.
4. Which characteristic doesn't belong to the Von Neumann architecture? (a) four functional units, (b) sequential execution of instructions, (c) stored program concept, (d) none of the above.
5. The content, 1100001111001001, in the register cannot represent: (a) an integer, (b) two characters, (c) four BCD codes, (d) four Excess-3 codes.
6. What is the size range of an audio file with the following characteristics: 44100 Hz, play time: 5 minutes, bit depth: 16 bits, stereo, no compression. (a) 30~40 Mbyte, (b) 40~50 Mbyte, (c) 50~60 Mbyte, (d) 60~70 Mbyte.
7. When the appearing frequencies of the following characters, *a*, *b*, *c*, *d*, *e*, and *f*, are 16, 5, 12, 17, 10, and 25 respectively, which bit pattern doesn't occur in the Huffman encoding? (a) 00, (b) 11, (c) 01, (d) 10.
8. Which describes the multiplexor? (a) 2^n input lines and 1 output line, (b) 2^n+n input lines and 1 output line, (c) n input lines and 1 output line, (d) n input lines and 2n output lines.
9. The sequence of Von Neumann cycle is (a) fetch-decode-execute, (b) decode-fetch-execute, (c) fetch-execute-decode, (d) execute-decode-fetch.
10. Which device is not applied in WAN? (a) Modem, (b) Router, (c) Switch, (d) ADSL.
11. Which protocol is not in the application layer? (a) SMTP, (b) IMAP, (c) UDP, (d) HTTP.
12. Which is the Logic programming language? (a) Pascal, (b) Ada, (c) Lisp, (d) Prolog.

13. Which one is not the encryption algorithm? (a) DES, (b) AES, (c) RSA, (d) none of the above.
14. There is a harddisk with the following characteristics: rotation speed=12000 rev/min, arm move time = 0.01msec to move to an adjacent track, number of tracks/surface=1000, number of sectors/track=50, number of bytes/sector=1024. What is the worst access time? (a) 1 msec, (b) 0.1 msec, (c) 0.5 msec, (d) none of the above.
15. When your computer is using virtual memory, the operating system builds a file called the page file on the (a) cache, (b) memory, (c) CPU, (d) hard drive.
16. Which one is not the necessary condition of deadlock? (a) hold and wait, (b) circular wait, (c) mutual exclusion, (d) no preemption, (e) none of the above.
17. Which statement about selecting the right programming language for a project is FALSE? (a) Some programming languages may take up too much space, (b) All programming languages require the same amount of time to execute, (c) Select a language that is easy for programmers to use and maintain, (d) Certain languages are customized to support the UNIX or Windows environment.
18. Which one is not the internal interrupt? (a) stack overflow, (b) I/O error, (c) illegal command, (d) divided by zero.
19. Which statement is false? (a) A multiprocessing system is a multiprogramming system, (b) A multiprogramming system is a time sharing system, (c) A multi-user system is a multiprogramming system, (d) A real time system is an on-line system.
20. When the page size is 2048 Bytes, each user program has at most 16 pages, and the physical memory consists of 32 Frames, by using how many bits could the logical address be represented? (a) 11 bits, (b) 12 bits, (c) 13 bits, (d) 14 bits, (e) 15 bits.

二、 問答題：(60%)

1. Please give a general outline of a successful recursive function definition. (B) And why might a recursive version of solution to a problem run slower than an iterative one that does the same thing? (10%)

2. Given the program, please answer whether the class member accesses of the labeled statements (a) to (e) are correct or not? If not, why? (10%)

```
#include <iostream>
using namespace std;
class CPUOfComputer {
        public:
                void load();
                void unload();
                // other public members
        private:
                int processNumber;
                int processPriority;
                // other private members
};
int main() {
        CPUOfComputer intol;
        intol.load();                           // a)
        intol.processPriority = 3;              // b)
        cout << intol.processNumber;    // c)
        cout << intol.unload()                  // d)
        if(intol.processNumber == 0)    // e)
                cout << "UserProcess";
}
```

3. What is the output from each of the following loops? (10%)

```
a)  while ( 0 )
        cout << 'Y';
    cout << endl;

b)  do
      cout << 'Y';
    while ( n != n );
    cout << endl;

c)  int i = 1;
    while (i < 6) {
      cout i;
      i++;
    }
    cout << endl;

d)  char c = 'K';
    do   {
      cout << c << " ";
      c = c + 2;
    } while ( c <= 'U' )
    cout << endl;

e)  int i = 0;
    while (i < 50)   {
      if ( i < 8 && i != 3 )
      cout << 'A';
      i++;
    }
    cout << endl;
```

4. Consider the following C program:

```
/*C code start from here */
void fun1(void); /* prototype */
void fun2(void); /* prototype */
void fun3(void); /* prototype */
void main() {
        int a, b, c;
        ...}
void fun1(void) {
        int b, c. d;
        ...}
void fun2(void) {
        int c, d, e;
        ...}
void fun3(void) {
        int d, e, f;
        ...}
/* End of C code */
```

What variables are visible when executing the last called function in the following calling sequences? Where was each of the variables defined?

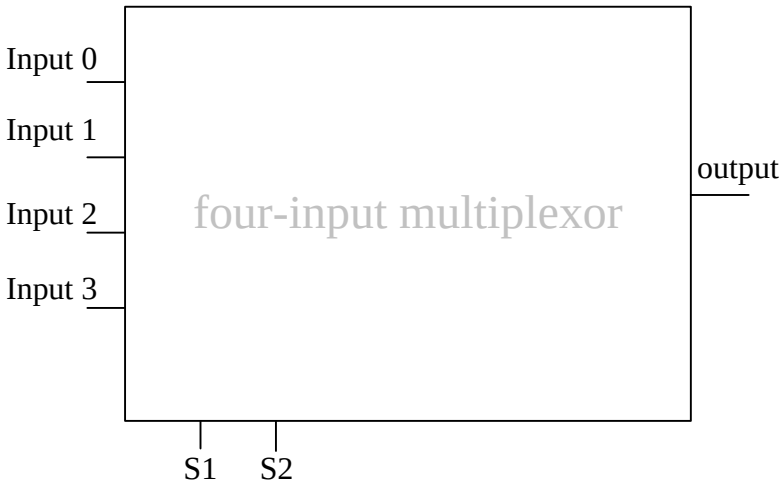
a. main calls fun1; fun1 calls fun2; fun2 calls fun3. (2%)
b. main calls fun1; fun1 calls fun3. (2%)
c. main calls fun2; fun2 calls fun3; fun3 calls fun1. (2%)
d. main calls fun3; fun3 calls fun1. (2%)
e. main calls fun1; fun1 calls fun3; fun3 calls fun2. (2%)

Example: main call fun3;
a, b, c defined in main
d, e, f define in fun3

5. Build a majority-rules circuit. This is a circuit that has three inputs and one output. The value of its output is 1 if and only if two or more of its inputs are 1; otherwise, the output of the circuit is 0 For example, if the three inputs are 0, 1, 1, your circuit

should output a 1. If its three inputs are 0, 1, 0, it should output a 0. Please create the truth table (3%) and build the circuit (7%).

6. Design a four-input multiplexor circuit. (10%)



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資料結構試題

適用學系：資訊科學學系

1. (10%)
   (1) What is the maximum number of nodes on level 6 of a binary tree?
   (2) What is the maximum number of nodes in a binary tree of depth 5?

2. Consider the Binary Tree in Fig. 1. Find (10%)
   (1) The inorder traversal: _____
   (2) The postorder traversal: _____

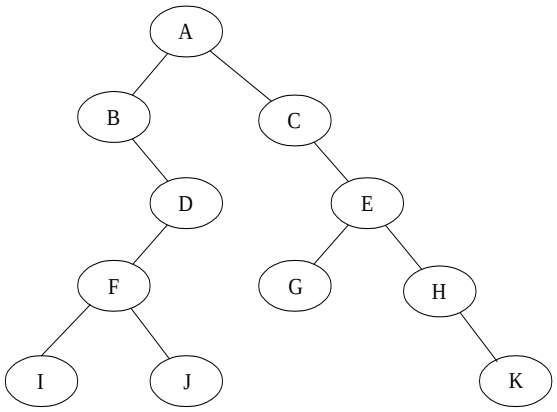

Fig. 1

3. Suppose that we have the following key values: 8, 16, 49, 5, 82, 31, 6, 2, and 45. (10%)
   (1) What is the definition of MAX heap?
   (2) Write out the MAX heap after each value is inserted into the heap.

4. Suppose that we have the following key values: 8, 16, 49, 5, 82, 31, 6, 2, and 45. (10%)
   (1) Write out the binary search tree after each value is inserted into the tree.
   (2) Write out the binary search tree after 16 is deleted from the tree.

5. Consider the two polynomials $A(x) = x^{12} + 2x^6 + 3x + 1$ and $B(x) = 3x^2 + x$. Suppose that these polynomials are stored in the array terms. The index of the first term of A and B is given by *starta* and *startb*, respectively, while *finisha* and *finishb* give the index of the last term of A and B. The index of the next free location in the array is given by *avail*. (10%)
   (1) What is the time complexity of polynomial addition using above data structure?
   (2) Complete Fig. 2.

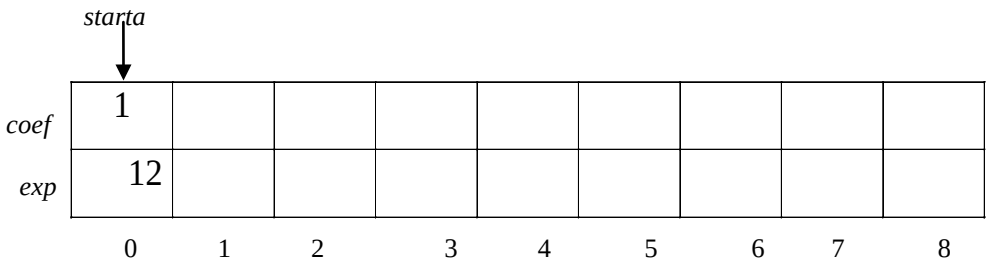

Fig. 2

6. A polynomial $C(x) = c_n x^n + c_{n-1} x^{n-1} + ... + c_1 x + c_0$. Explain your idea to evaluate the polynomial using a **minimum** number of multiplications. How many multiplications are needed with your idea? (10%)

7. We can save space and computing time by retaining only the nonzero term of sparse matrices. (10%)
   (1) Give a representation for sparse matrix for this purpose.
   (2) What are the time and space complexities of sparse matrix addition?

8. Apply Merge Sort to sort the numbers (20, 9, 11, 19, 24, 12, 14, 21) in nondecreasing order.

   (1) Show the action step by step. (7%)
   (2) Sum the total number of required comparisons. (3%)

9. Please fill in the blanks of the following Quick Sort algorithm: (10%)

Problem: Sort n keys in nondecreasing order.
Input: n (a natural number), array of keys S indexed from 1 to n.
Output: S containing the keys in nondecreasing order.

```
void quicksort (index low, index high)
{
    index pivotpoint;
    if (high > low) {
        partition (low, high, pivotpoint);
        _____(1)_____;
        _____(2)_____;
      }
}
void partition (index low, index high, index& pivotpoint)
{
    index i, j;
    keytype pivotitem;
    pivotitem = S[low];
    j = low;
    for ( i = low+1 ; i <= high; i++)
        if ( S[i] < pointitem) {
            ____(3)____;
            exchange ____(4)____;
        }
    pivotpoint = j;
    exchange ____(5)____;
}
```

quicksort (1, n);

10. Please fill in the blanks of the following table with either **Yes** or **No**: (10%)

property / asymptotic notation	Reflexive	Symmetric	Transitive
O (upper bound)	**Yes**	(1)	(2)
Ω (lower bound)	(3)	**No**	(4)
θ (exact order)	**Yes**	(5)	**Yes**