

國立清華大學 100 學年度碩士班入學考試試題

系所班組別：資應所甲組

考試科目（代碼）：計算機概論 (2301)

1. (10%) Give the binary search algorithm in pseudocode. Note that it should appear as a function/procedure with clearly defined input and output.
2. (10%) Design an algorithm that, when given an arrangement of the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, rearranges the digits so that the new arrangement represents the next larger value that can be represented by these digits (or report that no such rearrangement exists if no rearrangement produces a larger value). Thus 5647382901 would produce 5647382910.
3. (10%) (a) What are the advantages of using a relational database? (b) Design a relational database containing information about publishers, magazines, and subscribers. (Please try to avoid redundancies as much as possible.)
4. (10%) Assume that you have two buckets. One has a capacity of exactly 3 liters; the other has a capacity of 5 liters. You can pour water from one bucket to another, empty a bucket, or fill a bucket at any time. Your problem is to place exactly 4 liters of water in the 5-liter bucket. Describe how this problem could be framed as a production system.
5. (12%) (a) Is the number of lines of code (LOC) in a program a good measure of the complexity of the program? What are the pros and cons? (b) Please propose another method to estimate the program size and assess the complexity of the program.
6. (8%) What is multithreading? How can we implement thread synchronization?
7. (8%) What are the contributions of *reusability* and *inheritance* in software engineering?
8. (7%) The following code segment is a count-controlled loop going from 1 through 5. At each iteration, the loop counter is either printed or put on a queue depending on the result of Boolean function RanFun(). (The behavior of RanFun() is immaterial.) At the end of the

loop, the items on the queue are dequeued and printed. Because of the logical properties of a queue, this code segment cannot print certain sequences of the values of the loop counter. You are given an output and asked to determine if the code segment could generate the output. You have to explain your answers.

```
for (count = 1; count <= 5; count++)
    if (RanFun())
        cout << count;
    else
        queue.Enqueue(count);
while (!queue.IsEmpty())
{
    queue.Dequeue(number);
    cout << number;
}
```

- (i) The following output is possible using a queue: 1 2 3 4 5
(a) True (b) False (c) Not enough information
- (ii) The following output is possible using a queue: 1 3 5 4 2
(a) True (b) False (c) Not enough information
9. (15%) If each quantum in a time-sharing system is 50 milliseconds and each process switch requires 5 milliseconds, how many processes can the machine provide in a single second? If each process used its complete quantum, what is the fraction of the machine time spent on performing the processes? What would this fraction be if each process executes an I/O request after only 5 milliseconds of its quantum?
- 10.(10%) What are the differences between object codes and executable codes? What are their relations with linkers and loaders?