國立臺灣師範大學 100 學年度碩士班招生考試試題

科目：**計算機概論**　　適用系所：**資訊教育所**

注意：1.本試題共 4 頁，請依序在答案卷上作答，並標明題號，不必抄題。2.答案必須寫在指定作答區內，否則不予計分。

1. Data compression schemes fall into two categories. Some are lossless, others are lossy.

(a) In cases where the data being compressed consists of long sequences of the same value, the compression technique called run-length encoding is popular. Please use the following original data as an example to depict how run-length encoding works to derive a compressed data. (4 分)

BBBBBBBBBAAAAAAAAAAAAAAAANMMMMMMMMMM

(b) Is run-length encoding a lossless scheme? Why? (4 分)

(c) Another data compression technique is Huffman encoding. Please use the example in (a) to depict how Huffman encoding works. (4 分)

(d) Is Huffman encoding a lossless scheme? Why? (4 分)

(e) GIF and JPEG are two kinds of compression methods for images. Why would GIF be better than JPEG when encoding color cartoons? (4 分)

2. In a typical time-sharing/multitasking system many processes are normally competing for the computer's resources. Associated with a process is the current status of the activity, called the process state.

(a) What does it mean for a process to be ready? (4 分)

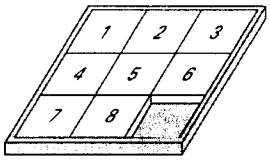
(b) Describe the major difference between a process and a program. (4 分)

(c) In a typical time-sharing/multitasking system, how can high-priority processes be allowed to run faster than others? (4 分)

(d) If each time slice in a time-sharing/multitasking system is 50 milliseconds and each context switch requires at most a microsecond, how many processes can the machine service in a single second? (4 分)

(e) The tasks associated with coordinating the execution of processes are handled by the scheduler and dispatcher within the operating system's kernel. What is the purpose of dispatcher? (4 分)

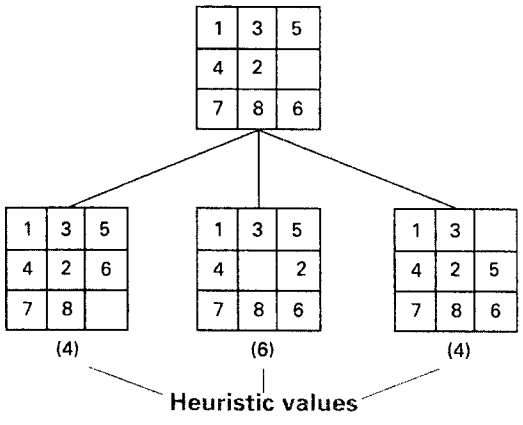
3. The eight-puzzle consists of eight square tiles labeled 1 through 8 mounted in a board with three rows and three columns. The problem posed is to move the tiles in a scrambled puzzle back to their final position, as shown below.

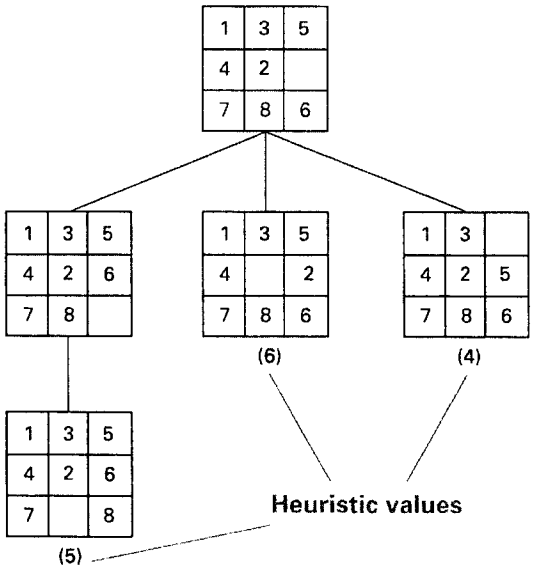


A heuristic for solving the eight-puzzle is to measure the distance each tile is from its destination and add these values to obtain a single quantity. A tile immediately adjacent to its final destination would be associated with a distance of one, whereas a tile whose corner touches the square of its final destination would be associated with a distance of two. We can use the best-first search algorithm to solve this problem. Let us apply this algorithm from the following initial configuration.

1	3	5
4	2	
7	8	6

First, we establish this initial state as the root node and record its heuristic value, which is five. Then, the first pass adds three nodes that can be reached from the initial configuration. The second pass adds one node that can be reached from the leftmost node with the smallest heuristic value, which is four. The following two figures show the search trees after one pass and two passes, respectively.





Note that we have recorded the heuristic value of each leaf node in parentheses beneath the node.

(a) Please state the reason why the heuristic value of the initial state is five. (4 分)

(b) Please show the search tree after three passes. (4 分)

(c) Please show the search tree after four passes. (4 分)

(d) Applying this algorithm, what is the solution of the above example? (4 分)

(e) Rather than building the search tree in a best-first manner, one can build it using the breadth-first approach. Please show how the breadth-first approach works. (4 分)

(f) One can also build the search tree using the depth-first approach. Please show how the depth-first approach works. (4 分)

(g) A simpler heuristic in the case of the eight-puzzle would be to estimate the "distance" to the goal by counting the number of tiles that are out of place. Why would this simpler heuristic not be as good a heuristic as the one used above? (4 分)

(h) The puzzle-solving technique can be formulated as a production system which consists of a collection of states, a collection of production rules, and a control system. For the eight-puzzle problem, what are the production rules? (4 分)

(i) Hashing is a technique that allows a record to be located by means of a key value. Please design a hash function for the eight-puzzle configurations. (4 分)

(j) What are the major advantages of hashing when it is used in the eight-puzzle problem? (4 分)

4. Please fill the following blanks.

(a) Interpret the binary number 11110110 in decimal if the number was stored as a two's complement integer. (2 分)

(b) _____ cells can be in a computer's main memory if each cell's address can be represented by eight hexadecimal digits. (2 分)

(c) Suppose you want to isolate the middle four bits of a byte by placing 0s in the other four bits without disturbing the middle four bits. What mask must you use together with the AND operation? (2 分)

(d) XML is abbreviated from extensible markup language and _____ is abbreviated from hypertext markup language. (2 分)

(e) The most fundamental concept in software engineering is the software life cycle. The major four development phases of the software life cycle are requirements specification, design, implementation, and _____. (2 分)

(f) Suppose a tree has four nodes A, B, C, and D. If A and C are siblings and D's parent is A, which node is the root? (2 分)

(g) A _____ database model stores its data in rectangular tables, called relations, which consist of rows and columns and are similar to the format in which information is displayed by spreadsheet programs. (2 分)

(h) What sequence of numbers would be printed by the following recursive procedure if we started it with N assigned the value 1? (2 分)

```
Procedure TEST(N)
{   print the value of N;
    if (N<3) then (apply the procedure TEST to the value N+1);
    print the value of N;
}
```

(i) Most modern programming languages are strongly typed. What does it mean to say that a programming language is strongly typed? (2 分)

(j) What does it mean to say that an algorithm is nondeterminisic? (2 分)