國立彰化師範大學 97 學年度碩士班招生考試試題

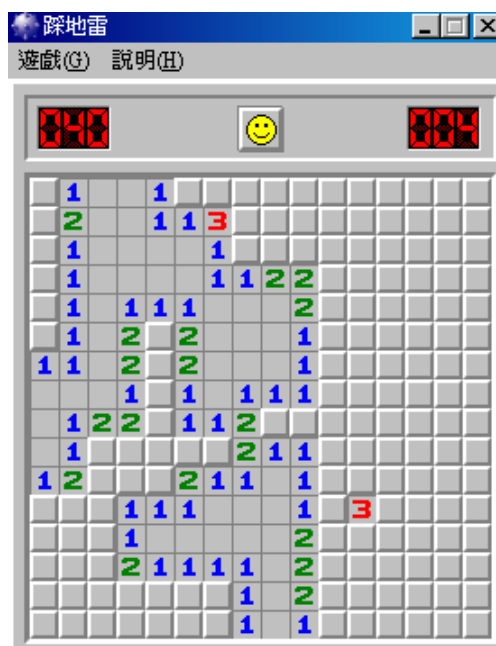系所：　數位學習研究所碩士班　　　　　　　　　　科目：　資料結構

Show all your work and write your answers clearly in the following questions. You may write the answers in English or Chinese.

1. (10%) Ordering by asymptotic rates in descending order.
   (a) $(\lg n)!$ (b) $(n+1)!$ (c) $\lg(n!)$ (d) $4^{\lg n}$ (e) $(3/2)^n$

2. (10%) Draw the expression tree, and find the infix and prefix expressions for the following postfix expression AB*CD/+EF-*.

3. Consider the hash table of size 23, where the hashing method using division (Modulo). If we insert the values 46, 47, 55, 151, and 178 in order. Answer the following sub-questions.
   (a) (2%) What are the contents of the hash table?
   (b) (2%) Give the instance of occurring collision when hash a new data item into a hash table.
   (c) (6%) How can you solve this problem in sub-question (b)? (at least list three kinds of method)

4. (15%) Explain P problem, NP problem, NP-hard problem, NP-complete problem, and their relations.

5. (20%) Consider a computer game "踩地雷" in the following figure. What search algorithm you will use to find all land mines (bombs)? If you don't know how to play that game, you can firstly define the game's rules. Explain your search algorithm, and analyze the time and space complexities of it.

6. (15%) Please explain each application of the data structure in the operation of a computer/information system.
   (a) Stack
   (b) Queue
   (c) Tree
   (d) Graph

7. (15%) (a) What is the fundamental concept behind the AVL trees？
   (b) What is the time complexity for finding the maximum value in a max heap？

8. (5%) What are the advantages and disadvantages of representing a group of items as an array versus a linear linked list？