

# 國立臺灣師範大學九十七學年度碩士班考試入學招生試題

計算機概論 科試題 (資訊教育研究所用, 本試題共 3 頁)

數位學習、電腦教育組

- 注意: 1. 依次序作答, 只要標明題號, 不必抄題。  
2. 答案必須寫在答案卷上, 否則不予計分。

本科目之試題共有 7 題, 滿分 100 分。各題所佔分數標示於各子題題目之後。

## 1. [Data Storage, Data Manipulation, Networks and the Internet]

Dotted-decimal notation is a method of representing bit patterns in which each byte in the pattern is represented by its base 10 equivalent. In turn, these byte representations are separated by periods. For example, 12.5 represents the bit pattern 0000110000000101 (the byte 00001100 is represented by 12 and 00000101 is represented by 5), and the pattern 10001000000100000000111 is represented by 136.16.7.

- (a) Please represent the bit pattern 011000110010100001001110 in dotted-decimal notation. (4 分)
- (b) What bit pattern is represented by 46.25.38 in dotted-decimal notation? (4 分)
- (c) IPv4 addresses are almost universally represented in dotted-decimal notation. How are they represented? (4 分)
- (d) Please define an alternative method "dotted-hexadecimal notation" similar to the above description. (4 分)

## 2. [Operating Systems]

The use of interrupts for terminating current running process is one of many applications of a computer's interrupt system. There are many situations in which an interrupt signal is generated, each with its own interrupt routine. Hence, interrupts provide an important tool for coordinating a computer's actions with its environment.

- (a) What is the major disadvantage if a computer doesn't have an interrupt system? (4 分)
- (b) What kind of services will be done when a power-failure interrupt is generated in an interrupt system? (4 分)
- (c) To manage the task of recognizing and responding to incoming interrupts, the various interrupt signals are usually assigned different priorities. What is the major advantage of this assignment? (4 分)
- (d) What is the major difference between an interrupt system and a time-sharing system? (4 分)

### 3. [Algorithms]

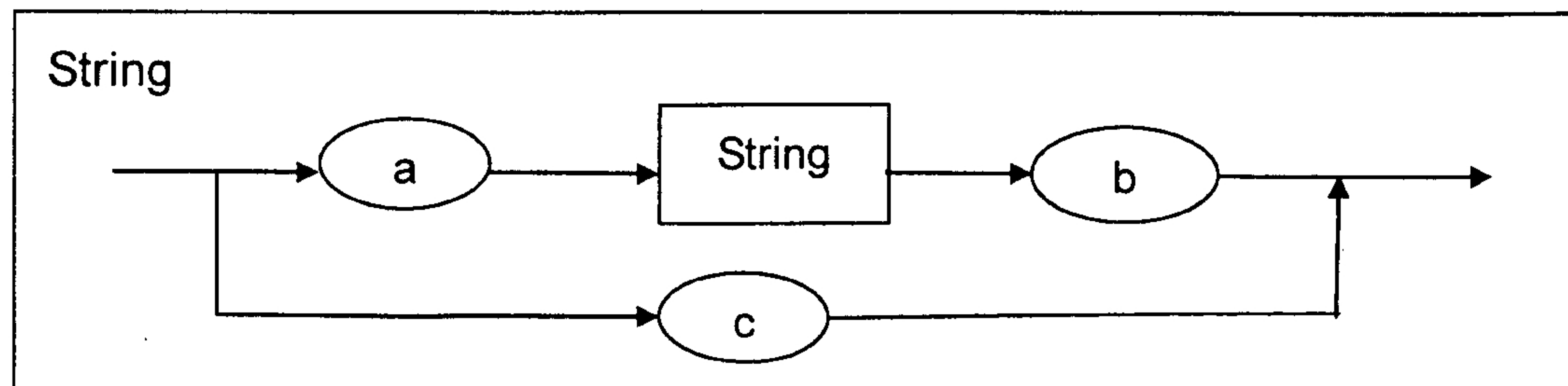
Dijkstra's algorithm is a graph search algorithm that solves the single-source shortest path problem for a graph with nonnegative edge costs. This algorithm is often used in routing. For a given source vertex  $s$  in the graph with edges  $E$  and vertices  $V$ , the algorithm finds the path with lowest cost (i.e. the shortest path) between the vertex  $s$  and every other vertex. The following shows a pseudocode for Dijkstra's algorithm.

```
1   $d[s] \leftarrow 0$ 
2  for each  $v \in V - \{s\}$ 
3      do  $d[v] \leftarrow \infty$ 
4   $S \leftarrow \emptyset$ 
5   $Q \leftarrow V$             $\triangleright Q$  is a priority queue maintaining  $V - S$ 
6  while  $Q \neq \emptyset$ 
7      do  $u \leftarrow \text{EXTRACT-MIN}(Q)$ 
8           $S \leftarrow S \cup \{u\}$ 
9          for each  $v \in \text{Adj}[u]$ 
10             do if  $d[v] > d[u] + w(u, v)$ 
11                 then  $d[v] \leftarrow d[u] + w(u, v)$ 
```

- (a) What is the purpose of the function  $\text{EXTRACT-MIN}(Q)$  in Line 7? (4 分)
- (b) What is the purpose of the statement " $v \in \text{Adj}[u]$ " in Line 9? (4 分)
- (c) Please modify the above pseudocode to find costs of shortest paths from a single vertex  $s$  to a single destination vertex  $t$ . (5 分)
- (d) A programmer suggests an algorithm that solves the single-source shortest path problem for a graph with *negative* edge costs. It adds a large constant to each edge cost so that all the costs become positive, then run Dijkstra's algorithm starting at node  $s$ . In this way, we can finally solve the problem. Is this a valid method? Please either prove that it works correctly, or give a counterexample. (5 分)

### 4. [Programming Languages]

- (a) What is the role of the *lexical analyzer* in the translation process? (6 分)
- (b) Write a sentence describing the structure of a string as defined by the syntax diagram below. (6 分)





**5. [Software Engineering]**

- (a) Suggest a metric for measuring software quality. What weaknesses does your metric have? (6 分)
- (b) What is the difference between system requirements and system specifications? (6 分)

**6. [Database Systems]**

- (a) Use an example to explain the term "schema." (6 分)
- (b) What distinguishes the nature of data mining activities from that of traditional database enquiries? (6 分)

**7. [Theory of Computation]**

- (a) Briefly explain the term "*Turing computable*." (6 分)
- (b) A *universal programming language*, called Bare Bones, has three assignment statements and one control structure as defined below:

- **clear *name***                      -- Associate the value 0 with a variable.
- **inc *name***                        -- Increment the value of the variable by 1.
- **dec *name***                        -- Decrement the value of the variable by 1.
- **while *name* not 0 do;**      -- Repeat the statement or statement sequence  
    ...                                  positioned between the **while** and **end** statements  
    ...                                  as long as the value of the variable *name* is not 0.  
    **end;**

(Note: *name* in the above statements represents any variable name.)

Describe the function computed by the following Bare Bones program, assuming the function's inputs are represented by P and Q and its output by R. (8 分)

```
clear R;
while P not 0 do;
  clear S;
  while Q not 0 do;
    incr R;
    incr S;
    decr Q;
  end;
  while S not 0 do;
    incr Q;
    decr S;
  end;
  decr P;
end;
```