**台灣省高級中學九十九學年度資訊學科能力競賽**

**彰雲嘉區程式設計複賽試題**

**每題100分**

一、 從鍵盤輸入一個三角形的三個邊長，請你判斷以此三邊長所組成的三角形是銳角 (acute)、直角 (right)、或是鈍角 (obtuse)三角形。輸入部分只有一行，含有三個由空白隔開的正整數 A, B, C (0 < A, B, C ≤ 46340)，代表三角形的邊長(注意：不限定由小到大輸入)。輸出部分：判別此三角形的類別然後依其所屬之類別輸出「acute triangle」、「right triangle」、「obtuse triangle」、或「無法形成三角形」。

**範例1**.

輸入：4 3 5

輸出：right triangle

**範例2.**

輸入：1 2 4

輸出：無法形成三角形

**範例3.**

輸入：7 12 6

輸出：obtuse triangle

**範例4.**

輸入：6 7 9

輸出：acute triangle

二、有一序列F=（1×3×5）＋（2×6×10）＋（3×9×15）＋．．．＋（N×M×L），由鍵盤輸入一正整數N，請判斷M與L 的值並計算F的值輸出。

**範例1.**

輸入：3

輸出：F=540

**範例2.**

輸入：5

輸出：F=3375

**範例3.**

輸入：10

輸出：F=45375

三、希爾加密法(Hill Cipher)是運用矩陣乘法計算的替代性加密技術(substitution cipher)，由Lester S. Hill在1929年發明。其轉換的方式為：

1. 首先，將明文(plaintext)的內容分割，每n個字視為一小組，分割成許多向量。若明文長度不為n之倍數，則於不足部分均填入字母X。
2. 將英文字不分大小寫以整數表示，其中A=0, B=1, C=2, …, Z=25，找出每個英文字所對應的數字。
3. 將已知或給定的加密金鑰矩陣()與每一小組的向量相乘(作矩陣對向量的乘法)。
4. 將步驟3計算所得向量的每一個元素均求除以26之餘數(mod 26)。
5. 將4所得的數字反推找出所對應的英文字即為密文(ciphertext)。

簡單來說，希爾加密法可用下列方式表示： ，其中是密文(ciphertext)分割後所形成的向量，是加密矩陣，是明文(plaintext)向量。本程式設計題僅需考慮n=2的情形，並假設加密矩陣為 。  
**範例1.**

利用希爾加密法可以將明文：HI TH ER EE 轉成密文 FQOODIQI。轉換的計算過程說明如下：  
1.找出各英文字對應之數字並以2個字為一組分作分割，若輸入之字串長度為奇數則於最後加上英文字X。(例如明文字串為CHINA則加上X變成CHINAX)。本範例明文數為偶數故不需加入X僅需作切割，如下：

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| H | I | T | H | E | R | E | E |
| 7 | 8 | 19 | 7 | 4 | 17 | 4 | 4 |

2.字組HI 經過矩陣對向量的乘法轉換爲FQ：

計算過程如下：

* 英文字串字HI 轉換成向量 [7 8]，
* 計算 ，
* 計算每一個元素除以26之餘數 ，
* 將數字反推找出所對應的英文字。

字組TH 經過矩陣運算轉換爲OO：

其餘類推。

**範例2.**

明文為 HSIUPING時所對應的數字陣列為 [7, 18, 8, 20, 15, 8, 13, 6]，經過希爾加密法轉換後，字串HSIUPING 被加密成字串 JKQONQFM。

從檔案T3.txt讀入資料，第一列的數字代表所要加密的字串數，其後每列為一個明文字串。請利用希爾加密法對每一個明文字串加密後輸出。

**範例輸入：  
2**HITHEREE

HSIUPING

**範例輸出：**

FQOODIQI

JKQONQFM

四、有一隻蝸牛爬在一個高度為**x**公尺(60)的牆上面，現正在牆上距地面**c**公尺的位置(其中xc0)，白天往上爬**u**公尺，晚上下降**d**公尺(其中u>d0)， 試寫一個程式，由鍵盤輸入x, c, u, d, k, l 。

(1) 計算出蝸牛*k*天*l*夜之後(其中kl0)會在離地面多少公尺的位置?

(2) 爬到牆頭需要多少天多少夜? (注意：爬上牆頭後便不會再下滑)

(3) 以圖示表示蝸牛的升降情形。

舉例說明如下：

**範例1.**

若輸入：15 3 5 3 4 4 (代表x=15, c=3, u=5, d=3, k=4, l=4)

則輸出：

1. 11
2. K=5, L=4
3. 蝸牛升降情形圖說明如下：

* 先於第一列印出0到數字x+u (此範例為15+5=20)之個位數字如下圖：
* 第2列標記**C**為起始位置並表示第一天白天上爬的情形，”**>**”代表上升之中間過程，”**X**”代表停留位置
* 第3列為第一天夜間下降的情形， “**<**”代表下降之中間過程，”**X**”代表停留位置。第4列為第2天白天上爬的情形 ，第5列為第2天夜間下降的情形；其餘依此類推。
* 最後一列於15處標示**G**代表牆高及最後超越的情形(於16處標示X)。

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **0** |
|  |  |  | **C** | **>** | **>** | **>** | **>** | **X** |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | **X** | **<** | **<** |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  | **>** | **>** | **>** | **>** | **X** |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  | **X** | **<** | **<** |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  | **>** | **>** | **>** | **>** | **X** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  | **X** | **<** | **<** |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  | **>** | **>** | **>** | **>** | **X** |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  | **X** | **<** | **<** |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  | **>** | **>** | **>** | **G** | **X** |  |  |  |  |

**範例2.**

若輸入：30 1 6 2 5 4 (代表x=30, c=1, u=6, d=2, k=5, *l*=4)

則輸出：

1. 23
2. K=7, L=6

(3)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **0** | **1** | **2** | **3** | **4** | **5** | **6** |
|  | **C** | **>** | **>** | **>** | **>** | **>** | **X** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | **X** | **<** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  | **>** | **>** | **>** | **>** | **>** | **X** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  | **X** | **<** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  | **>** | **>** | **>** | **>** | **>** | **X** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  | **X** | **<** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  | **>** | **>** | **>** | **>** | **>** | **X** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **X** | **<** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **>** | **>** | **>** | **>** | **>** | **X** |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **X** | **<** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **>** | **>** | **>** | **>** | **>** | **X** |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **X** | **<** |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | **>** | **>** | **>** | **>** | **G** | **X** |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

五、字串搜尋。請設計一個程式，要求使用者輸入一個英文關鍵單字，搜尋在所指定的文字檔中(T5.txt, 為一篇英文文章)含此關鍵單字（大小寫不拘）的所有句子，並依序在螢幕上輸出；若輸入檔中不含此關鍵單字，則在畫面上顯示“查無此字”。注意在此檔案中，句子的結尾可能是句點(.)和問號與雙引號(?”)。

T5.txt檔案內容如下：

ProxEasy serves as a barrier between you and the rest of the internet. All traffic which goes through this web-based proxy server service becomes completely anonymous because it is being bounced through the ProxEasy network. Just like you see on the movies, where hackers bounce their connections through multiple servers to hide their true location, so too does this web proxy server service make you totally untraceable and anonymous on the WWW. It lets you hide your ip from prying eyes. Ever ask yourself "How do I hide my ip**?"** Perhaps you may have been wondering how to access blocked websites that your school or workplace are preventing you from surfing with their filters that block users from getting on certain sites. Well this proxy server will actually allow you to get on those websites with ease, and hide your ip address at the same time. Or check the [directory](http://www.proxeasy.com/directory.asp). All you have to do is type in the URL or Web address of the sites you want to visit in the text box above and hit the "Go" button. Try ProxEasy now by typing a URL into the website address textbox on the form at the top of the page. I think you will like this web proxy server.

**範例1.**

若輸入的關鍵單字為：web

則輸出為：

1. All traffic which goes through this **web**-based proxy server service becomes completely anonymous because it is being bounced through the ProxEasy network.

2. Just like you see on the movies, where hackers bounce their connections through multiple servers to hide their true location, so too does this **web** proxy server service make you totally untraceable and anonymous on the WWW.

3. All you have to do is type in the URL or **Web** address of the sites you want to visit in the text box above and hit the "Go" button.

4. I think you will like this **web** proxy server.

說明：複合單字如上列第一筆輸出中之web-based要能被搜尋並輸出，但隱含之字串如Cobweb或website等則不可輸出。