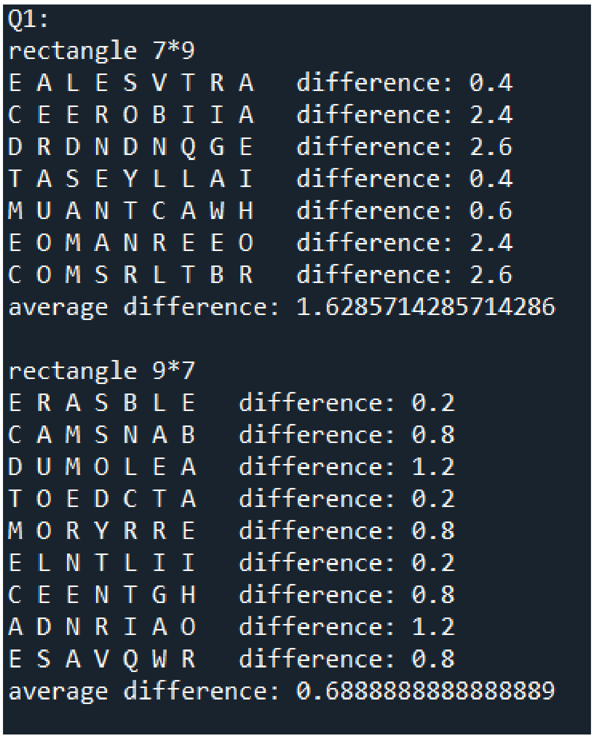
1.Please determine the dimension of the rectangle for this encryption cipher.

總共有 63 個字母，63 可以分成 7*9 或 9*7

如下圖可以看出 9*7 的 average difference 較低

也就是說 9*7 較符合 each row of the rectangle should be approximately 40% vowels.

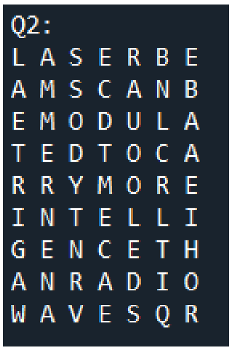
因此 dimension 為 9*7



```
Q1:
rectangle 7*9
E A L E S V T R A   difference: 0.4
C E E R O B I I A   difference: 2.4
D R D N D N Q G E   difference: 2.6
T A S E Y L L A I   difference: 0.4
M U A N T C A W H   difference: 0.6
E O M A N R E E O   difference: 2.4
C O M S R L T B R   difference: 2.6
average difference: 1.6285714285714286

rectangle 9*7
E R A S B L E   difference: 0.2
C A M S N A B   difference: 0.8
D U M O L E A   difference: 1.2
T O E D C T A   difference: 0.2
M O R Y R R E   difference: 0.8
E L N T L I I   difference: 0.2
C E E N T G H   difference: 0.8
A D N R I A O   difference: 1.2
E S A V Q W R   difference: 0.8
average difference: 0.6888888888888889
```

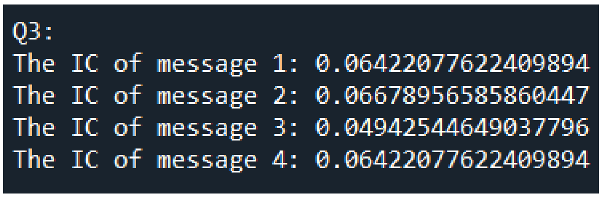
2.Please Solve this following transposition cipher which involves a completely filled rectangles from the HINT



```
Q2:
L A S E R B E
A M S C A N B
E M O D U L A
T E D T O C A
R R Y M O R E
I N T E L L I
G E N C E T H
A N R A D I O
W A V E S Q R
```

3. Please count Index of Coincidence (IC) for each messages.

依據公式 Index of Coincidence I.C. = $\frac{\sum_{i=A}^{i=Z}(f_i)(f_i-1)}{(N)(N-1)}$ message 的 IC 值如下



```
Q3:
The IC of message 1: 0.06422077622409894
The IC of message 2: 0.06678956585860447
The IC of message 3: 0.04942544649037796
The IC of message 4: 0.06422077622409894
```

可以看見第一個 message 是英文，所以 IC 約落在 0.066

可以看見第二個 message 是德文，所以 IC 也約落在 0.066

第三個 message 可以看出是加密過的，IC 值是 0.049，可推斷是 polyalphabetic

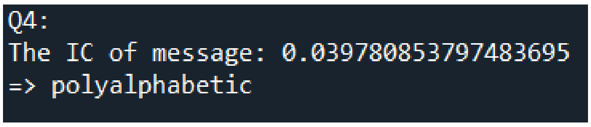
第四個 message 可以看出是加密過的，IC 值約落在 0.066，可推斷是 monoalphabetic

4. Given the following ciphertext, please determine if this encrypted message was enciphered using a monoalphabetic or polyalphabetic cipher based on the message's index of coincidence.

可以算出來此 ciphertext 的 IC 約為 0.039

而 The IC of English is around 0.066

0.039 遠小於 0.066，所以可以推斷說是 polyalphabetic



```
Q4:
The IC of message: 0.039780853797483695
=> polyalphabetic
```