

**High School Programming Competition**  
**Saint Anselm College, Saturday, April 11, 2015 @9:00-11:00 AM**  
**Contest Problems**

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**Problem 1. Ramanujan's (1887-1920) number**

Find the smallest number that can be written as the sum of 2 cubes in two different ways.

*Input:* - NOTHING-  
*OUTPUT:* -the number-

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**Problem 2. Spending Money**

You work in a tourist shop that sells hats for \$7, shirts for \$15, and jackets for \$23. If a customer comes to the store with X amount of money, can they spend it all without having any change left over? If so, what items do they buy and in what quantities. Keep asking for the amount of money until '0' is entered.

*Example.*

How much money do you have (stop with 0)? 33

**You cannot spend all your money!**

How much money do you have(stop with 0)? 36

**You can spend all your money: Hat: 3 Shirt: 1**

How much money do you have(stop with 0)? 89

**You can spend all your money: Hat: 2 Shirt: 5**

**Hat: 3 Shirt: 3 Jacket: 1**

**Hat: 4 Shirt: 1 Jacket: 2**

How much money do you have(stop with 0)? 0

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**Problem 3. Compression**

Given a string of 0 and 1's print how many are in each group. If the string starts with a 1, your output will start with 0, (interpretation: there is no ZERO at the beginning), if the string starts with a 0 you just print how many zeros are in the first group. For each group just print how many they are with a space in between. Keep asking for a string until 'q' or 'Q' is entered.

*Example.*

Enter string (q/Q for stop)? 00	<i>OUTPUT:</i> 2
Enter string (q/Q for stop)? 0011100111	<i>OUTPUT:</i> 2 3 2 3
Enter string (q/Q for stop)? 10011	<i>OUTPUT:</i> 0 1 2 2
Enter string (q/Q for stop)? 00011000	<i>OUTPUT:</i> 3 2 3
Enter string (q/Q for stop)? q	

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**Problem 4. Find similarities**

Given two strings find the longest common substring(s). Print the common substring and its length. If there is more than one substring of the same maximum length print them all. (Blank is considered a character.)

*Example:*

**Enter first string? ARITHMETICS**  
**Enter second string? MATHEMATICS**  
*OUTPUT:*       **TICS**           **#4**

*Example.*

```
Enter first string? aaaaabbccccc
Enter second string? aabbaaaaabccccc
OUTPUT:      aaaaa #5 bcccc #5
```

*Example.*

```
Enter first string? Dog
Enter second string? Cat
OUTPUT: #0
```

*Example.*

```
Enter first string? I am a very big fan of computer science contests
Enter second string? I am a big fan of science contests
OUTPUT:      science contests      #17 //(we count the two spaces also)
```

### Problem 5. Letters in Spiral

Fill a matrix (maximum size = 10 x 10) with random letters from the English alphabet (upper case). After you print the matrix and you have to print all the elements in a spiral order: left => right, up => down, right => left, down => up, and again.

*Example.*

```
Matrix size? 2
Matrix Generated:
B C
A S
OUTPUT: B C S A
```

*Example.*

```
Matrix size? 3
Matrix Generated:
B C D
A S V
X Y H
OUTPUT: B C D V H Y X A S
```

*Example.*

```
Matrix size? 4
Matrix Generated:
A B B B
E F F C
E G G C
D D D C
Output: A B B B C C C D D D E E F F G G
```

*Example.*

```
Matrix size? 5
Matrix Generated:
B C F G J
A S J H L
E X F G Y
I M J K L
M R T O P
OUTPUT: B C F G J L Y L P O T R M I E A S J H G K J M X F
```