Friday, April 06, 2018

**Contest Problems**

High School Coding Contest Saint Anselm College

Saturday, April 7, 2018 @9:00-11:00 AM

**I code therefore I am!**

General: We do not test for invalid input.

**Problem 1. Check Pythagoras**

Check if 3 given points in 2D space can be the vertices of a right triangle: (x1,y1), (x2, y2), (x3 ,y3). Points are given in the order x1, y1, x2, y2, x3, y3. The program should ask if you want to continue (more(y/n)?) and stops if you do not answer “y”.

Example1.

INPUT: Enter points? 0 1 0 0 1 0

Yes

more (y/n)? y

Enter points? 1 1 1 1 2 1

No

more (y/n)? n

**Problem 2. Many Tiles**

Find the minimum number of square tiles (w x w, w is an integer) to fill a given rectangle where its width and height are integer numbers. Find the number of tiles and their width. The program asks if you want to continue (more(y/n)?) and stops if you do not answer “y”.

Example 1.

Enter width, height? 30 50

1 x 30 1 x 20 2 x 10

*Means you can cover the 30 x 50 rectangle by:*

*one tile of size 30x30, one tile of size 20x20 and one tile of size 10x10.*

Example 2.

Enter width, height? 24 200

8 x 24 3 x 8

more (y/n)? y

Enter width, height? 7 23

3 x 7 3 x 2 2 x 1

more (y/n)? y

Enter width, height? 13 125

9 x 13 1 x 8 1 x 5 1 x 3 1 x 2 2 x 1

more (y/n)? y

Enter width, height? 2 0

more (y/n)? n

**Problem 3. Decrypt the message. Caesar’s Cipher**

Write a program that given a secret word (only letters, uppercase and no blanks) will help you decipher it. You know that the program uses an encrypted algorithm called *Caesar’s Cipher*, which means the letters of the English alphabet are “pushed” forward with n positions (n > 0). That is for n = 3, **ART** will be encrypted as **DUW**, and **ZEN** will be encrypted as **CHQ**. You will write a program for decrypting the text, assuming 3 <= n <= 6. As such the program will propose 4 possible decryptions.

Example1. Input: Enter encrypted message? **ORYH**

Output: **LOVE KNUD JMTC ILSB**

Example2. Input: Enter message? **IXQ**

Output: **FUN ETM DSL CRK**

Example3. Input: Enter message? **CHQ**

Output: **ZEN YDM XCL WBK**

**Problem 4. Teams for contest**

The CS teacher has N (3 <= N <= 26) students. Let’s call them a, b, c,.. z. The coding contest is coming and the teacher needs to select one group of 3 students. How many possible choices are there? Display them and count them.

Example1. INPUT: How many students? 3

OUTPUT: abc Total=1

Example2. How many students? 5

abc abd abe acd ace ade bcd bce bde cde Total=10

How many students? 6

abc abd abe abf acd ace acf ade adf aef bcd bce bcf bde bdf bef cde cdf cef def Total=20

**Problem 5. Reordered Primes**

Print all prime numbers that have k (2 =< k < 8) non-repeating digits

with the property that if you switch the **first** digit with the **last** they are still prime numbers. For example, 1049 switched will be 9041. Also display the amount of numbers for each case.

EXAMPLE1.

How many digits(2-7)?4

1049 1063 1249 1289 1327 1429 1439 1487 1493 1543

1567 1583 1597 1609 1627 1693 1697 1789 1823 1847

1879 1907 3019 3049 3061 3109 3209 3217 3257 3469

3491 3527 3541 3581 3607 3691 3821 3967 7069 7129

7159 7213 7253 7321 7481 7523 7549 7561 7589 7591

7603 7621 7691 7841 7901 7963 9013 9041 9043 9067

9103 9127 9157 9203 9241 9281 9421 9431 9463 9547

9587 9601 9781 9871 Many= 74