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
```