Base-10-Happy Prime Numbers

This problem will test your ability to convert a specification to a program as well as follow instructions. Read all instructions carefully. Any deviation will count against you.

Problem Description

There is a set of base-10 numbers known as "happy" numbers. There is also a set of base-10 numbers known as "prime" numbers. The intersection of those sets (numbers that are both happy and prime) are called "happy prime" numbers.

Assignment

Write a Java program classify a number as happy, prime, happy-prime, or composite (or any combination of those sets.) If the number is composite, compute its prime factors and state whether each factor is happy or not (by definition it is prime.) Design your program as follows:

1) public class HappyNumber

a) Contains the function

public static boolean isHappy(int n) throws IllegalArgumentException

Returns **true** if n is happy, **false** if it is not, throws an **IllegalArgumentException** exception if n is less than 0

b) Contains any other **private** functions that you deem necessary

2) public class PrimeNumber

a) Contains the function

public static boolean isPrime(int n) throws IllegalArgumentException

Returns **true** if n is prime, **false** if it is not, throws an **IllegalArgumentException** exception if n is less than 0. Note that 1 is not a prime number, by definition.

b) Contains the function

public static int[] primeFactors(int n) throws IllegalArgumentException

Returns an array of prime factors of n.

c) Contains any other **private** functions that you deem necessary

3) public class MainApp

a) Contains the function

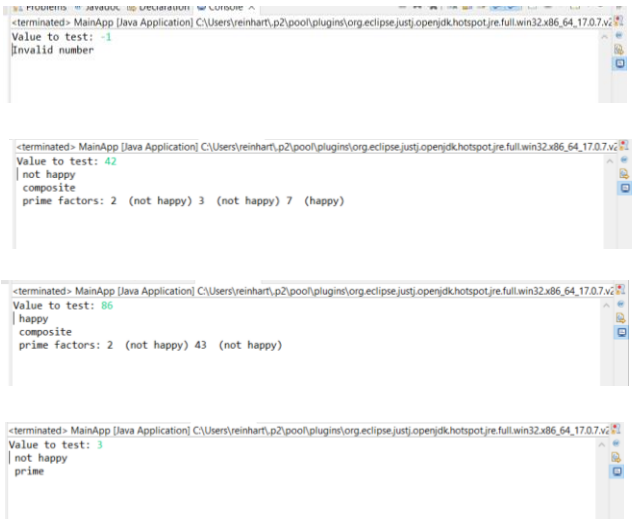
```
public static void main(String[] args)
```

Receives an integer from the keyboard and classifies it as happy, prime, happy-prime, or composite (or any combination of those sets.) If it classifies as composite then it will compute and print out the prime factors for the number and whether each prime factor is happy or not. If the user provides an invalid number as input (e.g. negative, floating point, character string…) this function should catch a **`InputMismatchException`** exception and explain what was wrong with the input.

b) Contains no other functions.

Deliverables

1. Your source code files.
2. A document containing
    a. Multiple **screen shots** of the running program. The screen shots should look similar to these



Run the code with the following inputs from the keyboard: -1, 'X', 2.7, 0, 1, 11, 42, 86, 7. That is, run the program nine times providing the given inputs and show the screen shot for each run.

b. A brief description of **how** you went about writing the program. For example: did you just sit down and start writing code? Did you work out the math by hand first? Did you seek additional sources of information?

c. How did you test your program to ensure correctness? That is, how do you know your program generated the correct answers?

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