Fall, 2013 CIT 590

Programming Languages and Techniques
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Homework 1

August 30, 2013; Due September 6, 2013, *midnight*

This homework deals with the following topics

* using the IDLE

* getting started with Python

* writing basic functions

Problem .

In this assignment we will use several number theoretic definitions and learn to write small programs to check whether a number from 1 to 10000 satisfies those properties.

The definitions we will use are

- Prime number - A number whose only divisors are the number 1 and the number itself.
- Perfect number - A number is said to be perfect if it is equal to the sum of all its divisors (for obvious reasons the list of divisors being considered does not include the number itself). $6 = 3 + 2 + 1$, hence 6 is perfect. 28 is another example.
- Abundant number - A number is considered to be abundant if the sum of its divisors is greater than the number itself. For instance 12 is abundant since $1 + 2 + 3 + 4 + 6 = 16 > 12$
- Narcissistic number - An n digit number is said to be Naricissistic if the sum of the n^{th} powers of its digits sums up to the number itself. It is trivial to see that all the single digit numbers are narcissistic. A non-trivial example is $153 = 1^3 + 5^3 + 3^3$.
- Harshad number - A number that is divisible by the sum of its digits. For instance 18 is Harshad because $1 + 8 = 9$ divides 18.
- Hexagonal number - A number that can be expressed in the form $2n^2 - n$. Hexagonal numbers come from a general class of numbers called figurative numbers. The nth hexagonal number will be the number of points in a hexagon with n regularly spaced points on a side as shown in the figure below.

Write 6 Python programs with at least the following functions

- isPrime(x) - function that returns whether or not the given number x is prime
- isPerfect(x) - code that returns whether or not the given number x is perfect
- isAbundant(x) - code that returns whether or not the given number x is abundant
- isNarcissistic - code that returns whether or not the given number x is narcissistic
- isHarshad(x) - code that returns whether or not the given number x is Harshad
- isHexagonal(x) - code that returns whether or not the given number x is Hexagonal

and one special function

main():
a function that asks a user for a number between 1 and 10000 and returns whether or not the number is prime, perfect, abundant, Harshad and hexagonal. If the user inputs a number that is outside the range of acceptable input, your program should handle that by printing a useful error message. Else it should print something like this (assuming the input number is 6)

x is not prime, is perfect, is not abundant, is Narcissistic, is not Harshad, is hexagonal

At the end of your Python program (after all your function definitions), insert the following lines:

```
if __name__ == "__main__":

    main()
```

Here's what this does. If you are in the IDLE window containing your program, and you click F5 (or choose Run - Run module) from the menu, IDLE will automatically run your main function. If you are in the IDLE window containing your test cases (supplied) and click F5 or use the menu equivalent, it will run the tests and tell you the results.