Homework 3 - Math 381 A - Autumn 2017 - Dr. Matthew Conroy

There are two problems below.

You need to do exactly one of them.

Look at your student id number.

If the right-most digit of your student id number is odd, do problem #1.

If the right-most digit of you student id number is even, do problem #2.

1. Define a graph $G = (V, E)$ as follows.
   Let $V = \{1, 2, 3, \ldots, 10\}$.
   Define $E = \{(i, j) : i, j \in V, i \neq j, i + 4j$ is prime or $j + 4i$ is prime$\}$.
   Create and solve (using lpsolve) an IP to find the chromatic number of G, $\chi(G)$.
2. Define a graph $G = (V, E)$ as follows.
   Let $V = \{1, 2, 3, \ldots, 10\}$.
   Define $E = \{(i, j) : i, j \in V, i \neq j, i + 5j$ is not prime or $j + 5i$ is not prime$\}$.
   Create and solve (using lpsolve) an IP to find the chromatic number of G, $\chi(G)$.

Be sure to give a complete explanation of your method of solution.

Explicitly list your objective function and all constraints in your IP.

Include *all* code you write to solve the problem, and *all* software output.

You are welcome to use any programming language(s).

Please use the following format.

1. Problem statement
2. Description of solution method including the mathematical formulation of the IP you will be using. Explain your method thoroughly.
3. Code to generate the lpsolve input file
4. The lpsolve input file. Be sure to truncate it: give one or two examples of each type of constraint, then remove the others, and indicate the number of constraints of each type removed.
5. Information about how you ran lpsolve on the above file, including run time and machine used, and the lpsolve solution output. Be sure to truncate it: leave out all variables which are equal to zero, and indicate that you have done this (e.g., "All other variables equal zero.").
6. Answer the question.

Note: Suppose a and b are positive integers.

We say that a is a *divisor* of b if $b = ak$ for some integer k.

A *prime* is an integer greater than 1 that has no divisors other than 1 and itself.

The sequence of primes begins $2, 3, 5, 7, 11, \ldots$.