

## Math 3170: Homework 12

Due: December 12, 2012

1. The following is true for a party involving  $n$  guests.
  - In any group of three guests, there are two that do not know one-another.
  - In any group of seven guests, there are two that know one-another.
  - (a) Give an upper bound on the number of guests based on a Ramsey number (you don't need to know the value of the Ramsey number).
  - (b) Suppose there is a gift exchange and every guest brings a gift for every other guest they know. Show that there are at most  $6n$  gifts that come to the party.  
Hint: For (b), show that every person knows at most 6 people.

2. Show that  $R(k-1, l)$  and  $R(k, l-1)$  are both even, then

$$R(k, l) < R(k-1, l) + R(k, l-1).$$

Hint: Assume that  $K_{R(k-1, l) + R(k, l-1) - 1}$  has no red  $K_k$  or blue  $K_l$ , find the red degree of any vertex, and then count how many red edges it must have.

3. For your project topic, come up with two homework problems:
  - The first should be easy enough that someone can solve it using knowledge obtained only in your presentation,
  - The second should be harder, solvable only by having read and understood your paper.

Give clear statements and solutions for each.