# Discrete Optimization - Assignment 2

## Theoretical part

First, we start by clarify the notation. We are given element and sets where . Further we are given a cost function defined for each . The ILP problem is:

Solving the LP-relaxation yields a potentially fractional solution, . We then let be the sets that are picked in the fractional solution. That is, . Note that for due the constrains the problem; if than one could reduce the primal variable and still satisfy all constrains for edges that is covered by

Going through the random rounding algorithm in section 14.2 yields a solution where repetitions is chosen such that:

It then follows that:

For less than half the elements to covered require the union events of . Applying the union bound yields:

The integrality gap of LP relaxation is as argued in Vazirani on page 111:

The corresponds between the logarithm and the harmonic series is:

Thus, the complementary probability of interest is:

**THAT FAIL**

Hence, the upper bound for the non-covered elements have an upper bound given by a binomial distribution with elements and a probability . Let . Then: