Homework #3
CS672 Spring 2020

Due Mon Apr 20, by 2:10pm

General Instructions   The following assignment is meant to be challenging. Feel free to discuss with fellow students, though please write up your solutions independently and acknowledge everyone you discussed the homework with on your writeup. I also expect that **you will not attempt to consult outside sources, on the Internet or otherwise,** for solutions to any of these homework problems. Finally, unless otherwise stated please provide a formal mathematical proof for all your claims.

Note   In order to disincentivize skipping class to finish the homework, I have made it due within 10 minutes of the beginning of class. If you need more time, consider using one of your late days.

Problem 1. (8 points)
W&S Problem 7.7 (2 points for part (a), 4 points for part (b), and 2 points for part (c))
Hint: For part (b), consider the linear program which attempts to select at least one edge from each cut $\delta(S)$ with $|S| \not\equiv 0 (\bmod\ k)$.

Problem 2. (10 points)
W&S Problem 8.6 (2 points each part.)
Hint: For part (c), use the following version of Holder's inequality: $\sum_{i=1}^{n} a_i b_i \leq (\max_i |a_i|)(\sum_i |b_i|)$.
Hint: For part (d), use the $O(\log k)$ approximation algorithm for Multicut.

Problem 3. (8 points)
W&S Problem 6.7.
Hint: In the formulation of Max 2SAT presented in class, assuming the instance is balanced simplifies the expression for the objective function.