Saarland
Informatics Campus

Assignment 5, Approximation Algorithms
Summer term 2017

Tobias Mömke, Hang Zhou
http://www-cc.cs.uni-saarland.de/course/61/

Due: 30 May 2017

Exercise 5.1 (10 Points)
Derandomize the rounding algorithm in Section 4 of the lecture to obtain a deterministic $(1-\frac{1}{e})$-approximation algorithm for MAX SAT.

Exercise 5.2 (10 Points)
Show Theorem 3 of the lecture:

Choosing the better solution of the randomized sampling algorithm and the randomized rounding algorithm gives a (3/4)*-approximation algorithm for MAX SAT.*

(Hint: The expected value of this solution is at least the average of the expected values of the solutions of these two algorithms.)

Exercise 5.3 (10 Points)
Let y^* be an optimal fractional solution obtained by solving the linear program for MAX SAT. Consider the following randomized rounding algorithm: we set each x_i to true with probability $\frac{1}{2}y_i^* + \frac{1}{4}$.

Show that this gives a randomized $\frac{3}{4}$-approximation algorithm for MAX SAT.

Exercise 5.4 (10 Points)
Consider the Set Cover problem and its linear program relaxation (see Lecture 4). Let x^* be an optimal fractional solution obtained by solving the linear program for Set Cover. Consider the following randomized rounding algorithm: a set S_j is included in the solution with probability $\min((2\ln n) \cdot x_j^*, 1)$.

Show that this gives a randomized $O(\ln n)$-approximation algorithm for Set Cover.