

1 Theoretical part

4.1 (due Mar 4, 2008) CLRS 29.1-4, 29.1-5, 29.1-6, 29.1-7, 29.1-8, 29.1-9, 29.3-6, 29.4-5.

2 Applied part (due Mar 4, 2008)

4.2 (due Mar 4, 2008) Implement the simplex algorithm with random pivot rule. Your implementation should use exact arithmetic (using GMP).

To test your program generate an $n \times n$ matrix A with independently random entries, $P(a_{ij} = 1) = P(a_{ij} = -1) = 1/2$; and then consider the following linear program

$$\min \sum_{i=1}^n \sum_{j=1}^n z_{ij}$$

$$z_{ij} \geq a_{ij} - x_i - y_j \quad (\text{for } i, j \in [n]),$$

$$z_{ij} \geq -a_{ij} + x_i + y_j \quad (\text{for } i, j \in [n]).$$

Run your program for $n = 1, \dots, 20$, take average of the objective over 50 runs for each value of n and plot the function.

How large value of n can your program handle? $n = 100$? $n = 200$?