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Approximation Algorithms

Fall 2001

Assignment 9

Problem 27 (2 points)**:**
Formulate the maximum independent set problem as a linear integer program.

Problem 28 (2 points)**:**
Formulate the travelling salesman problem as a linear integer program.

Problem 29 (5 points)**:**
The MAX2SAT problem is a restricted form of the MAXSAT problem in which every clause consists of at most 2 literals. The decision variant of MAX2SAT is NP-complete.
Consider the following arithmetization of MAX2SAT: For every Boolean variable x_i we introduce a variable $y_i \in \{-1, +1\}$. In addition, there is a variable y_0 that can also only take values in $\{-1, +1\}$. Clauses of length 1 can be arithmetized via the following expressions:

$$C_j = x_i \quad : \quad \text{use } \frac{1 + y_i \cdot y_0}{2}$$

$$C_j = \bar{x}_i \quad : \quad \text{use } \frac{1 - y_i \cdot y_0}{2}$$

Similar formulas can be given for clauses of length 2.

(a) Give all 4 possible expressions for clauses of length 2. (2 points)

(b) Formulate a MAX2SAT instance as a quadratic program. (2 points)

(c) Formulate a semidefinite program as a relaxation of the quadratic program. (1 point)

Problem 30 (1 point)**:**
Derandomize $C_{1/2}$ completely under the assumption that derandomized versions are given for A and B.