

COMP3821 Homework 4

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Question 3.

3.1 Discrete Variables.

j , a discrete variable that takes a value from 1, 2...10, and inv_j represents the j th investment.

I , a set containing the opportunities that are undertaken.

x_j , a value either of 0 or 1 denoting whether an investment is undertaken.

3.2 Continuous Variables.

P_j is the gross profit obtained after undertaking inv_j .

C_j is the initial cost required for inv_j .

Q is the total capital available for investment.

3.3 Constraints.

$Q \geq 0$. If $Q = 0$, then the best investment is simply $I = \{\}$.

Either $inv_3 \in I$ OR $inv_4 \in I$, but not both.

Either $inv_5 \in I$ OR $inv_6 \in I$, but not both.

Unless $inv_3 \in I$ OR $inv_4 \in I$, $inv_5 \notin I$ and $inv_6 \notin I$.

I must contain elements $inv_g \in V = \{1, 2, 7, 8, 9, 10\}$ such that, $2 \leq \sum_{inv \in I} inv_g \leq 4$.

3.4 Objective.

We want an I such that net-profit(I) is maximized. The net profit for each investment is $N_j = P_j - C_j$, so the goal is to choose some I containing the maximum $\sum_{N_j \in I} N_j$. i.e. the goal is to maximize,

$$N_{max} = N_1x_1 + N_2x_2 + N_3x_3 + \dots + N_{10}x_{10}$$

for $0 \leq x_j \leq 1$

3.5 Polynomial-Time solvability.

The following choices are selected,

- Yes, regardless of P vs. NP.
- Yes, if P = NP. No otherwise.