COMP3821 Homework 4

Jason Qin, z5258237

April 2020

Question 3.

3.1 Discrete Variables.

j, a discrete variable that takes a value from $1, 2...10$, and inv_j represents the jth 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, $2 \leq \sum_{inv \in I} inv_g \leq 4$. The total cost $C(I)$ is no greater than Q. I.e. $\sum C_i \leq Q$.

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,

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

for $x_j = 0$ or 1.

3.5 Polynomial-Time solvability.

The following choices are selected,

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