We have \( c_1, d_1, \ldots, c_k, d_k \) vectors. You are given the problem

\[
\max \sum_{i=1}^{k} \max \{c_i^T x, d_i^T x\} \quad \text{st.} \quad Ax \leq b
\]

(0.1)

You can assume that \( Ax \leq b \) implies

\[-M \leq c_i^T x, d_i^T x \leq M\]

(0.2)

1. To model this as an LP/IP, does the following work? Rewrite (0.1) as

\[
\max \sum_{i=1}^{k} \min \{-c_i^T x, -d_i^T x\} \quad \text{st.} \quad Ax \leq b
\]

(0.3)

and model (0.3) as an LP, as we have seen in class.

Either prove that this works, or give a simple counterexample that shows that it gives the wrong answer.

If this model is wrong, describe a correct one.

2. Use your model to

(a) find the portfolio with the maximum ADR with the dataset risk2.dat among all portfolios. Compare the ADR with the minimum possible ADR, and compare the corresponding portfolios.

(b) find the portfolio with the maximum ADR with the dataset risk2.dat among all portfolios whose return is maximum (the maximum value of the return is 1.238). Compare the ADR you get with the minimum possible ADR, among the portfolios with this return, and compare the corresponding portfolios.

(c) What can you say about the portfolios with maximum and minimum ADR?