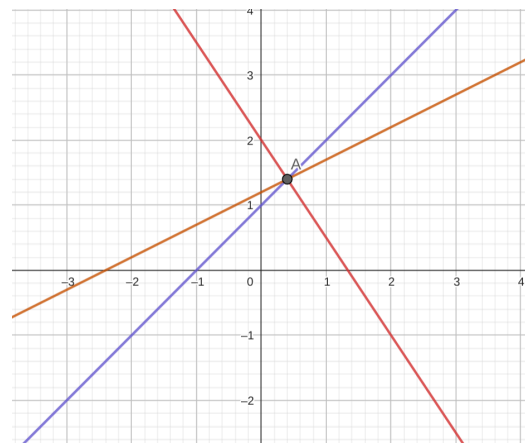# Assignment10 : Vertex Cover Problem

- Zitong Huang, 12432670, Computer Science and Engineering

- Scene Reconstruction

- Prof. Feng Zheng

Task 10-1

Target: $\max Z = \mathbf{c}^T \mathbf{x} = [-1,\ 2]\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$

Subject to: $\begin{bmatrix} 3 & 2 \\ -1 & 1 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \leq \begin{bmatrix} 4 \\ 1 \end{bmatrix}, \quad x_1, x_2 \geq 0$

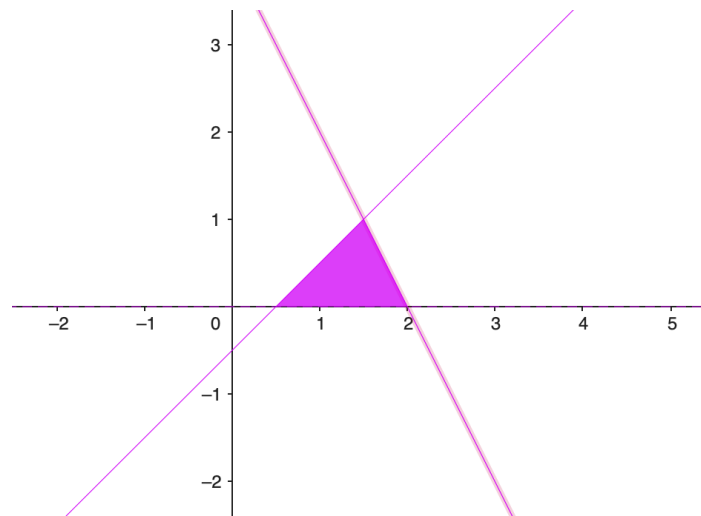| Algorithm	x_1	x_2	Z
HiGHS[1]	0.4	1.4	2.4
Simplex[2]	0.4	1.4	2.4

[1] Huangfu, Q., & Hall, J. J. (2018). Parallelizing the dual revised simplex method. Mathematical Programming Computation, 10(1), 119-142.

[2] Dantzig, G. B. (1948). Programming in a linear structure. Econometrica, 17(1), 73–74.

Task 10-1

Target: $\max Z = \mathbf{c}^T \mathbf{x} = [2,\ 1]\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$

Subject to: $\begin{bmatrix} 2 & 1 \\ -2 & 2 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} \leq \begin{bmatrix} 4 \\ -1 \\ 0 \end{bmatrix}, \quad x_1, x_2 \geq 0$
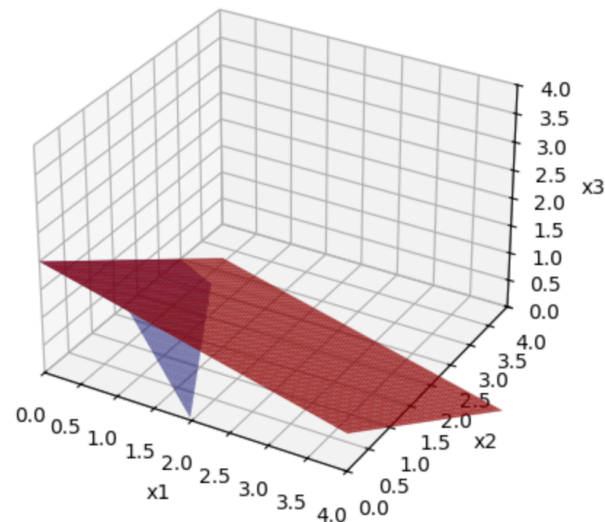

Algorithm	x_1	x_2	Z
HiGHS[1]	2	0	4
Simplex[2]	2	0	4

[1] Huangfu, Q., & Hall, J. J. (2018). Parallelizing the dual revised simplex method. Mathematical Programming Computation, 10(1), 119-142.

[2] Dantzig, G. B. (1948). Programming in a linear structure. Econometrica, 17(1), 73–74.

Task 10-1

$$\max Z = \mathbf{c}^T \mathbf{x} = [1, \ 2, \ 3] \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

Subject to:
$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 1 \\ 1 & 1 & 2 \\ -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \leq \begin{bmatrix} 6 \\ 4 \\ 5 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

Algorithm	x_1	x_2	x_3	Z
HiGHS[1]	0	0	2	6
Simplex[2]	0	0	2	6

[1] Huangfu, Q., & Hall, J. J. (2018). Parallelizing the dual revised simplex method. Mathematical Programming Computation, 10(1), 119-142.

[2] Dantzig, G. B. (1948). Programming in a linear structure. Econometrica, 17(1), 73–74.

Task 10-2

Instances	HiGHS time (s)	HiGHS optimal	Interior-Point[1] time (s)	Interior-Point optimal
small	0.0012	8106.530114360896	0.008	8106.530114300792
medium	2.5243	5653427.100619743	1.5281	5653427.098690189
large	69.2118	54087865.84468825	58.5074	Failed to Solve

[1] Dikin, I. I. (1967). Iterative solution of problems of linear and quadratic programming. Doklady Akademii Nauk SSSR, 174(4), 747–748.