Data & Analytics

Introduction to linear programing

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Decision Variables

Objective function

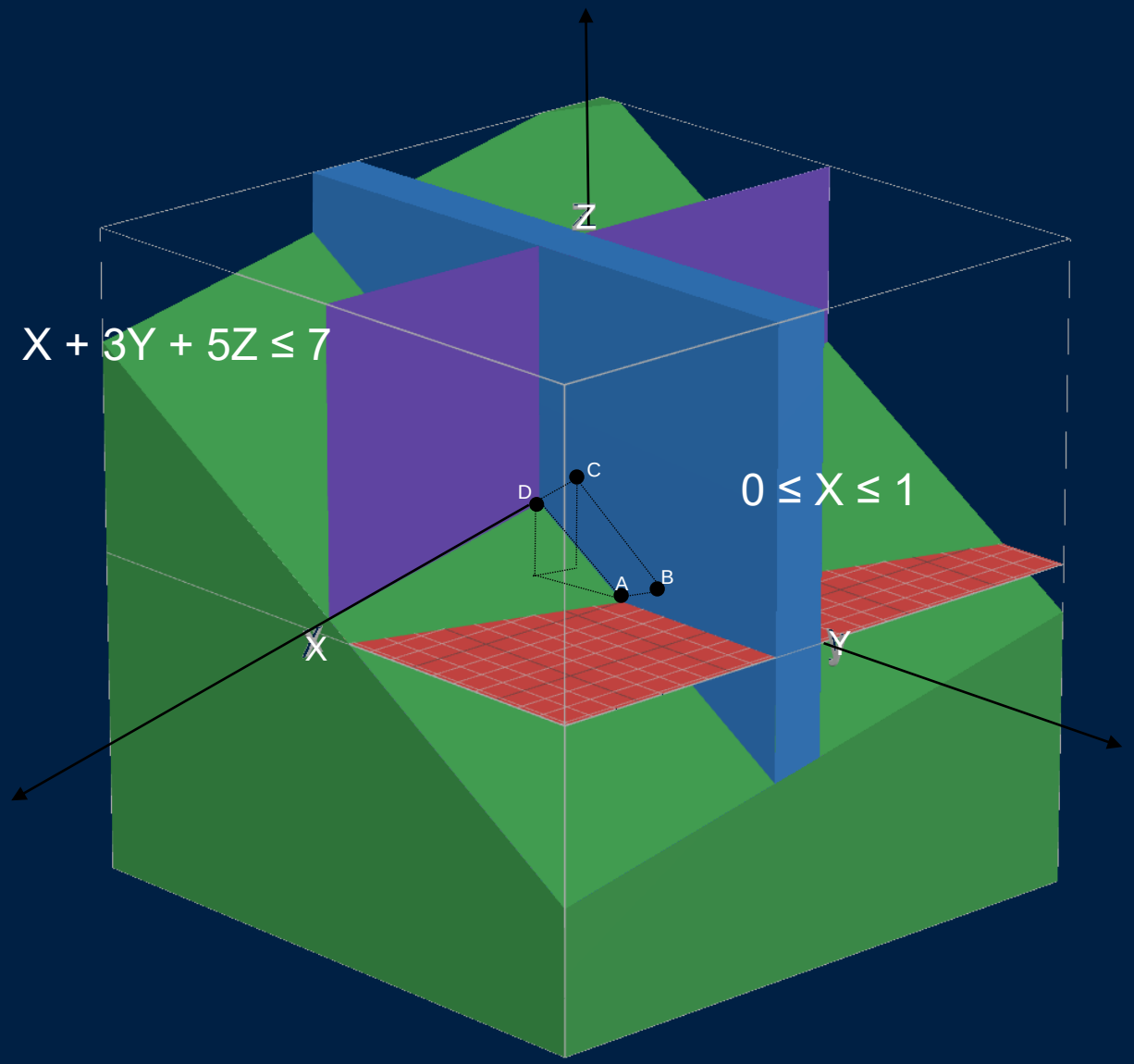
Constraints

	X	Y	Z
value	3	4	11
weight	1	3	5

Problem formulation

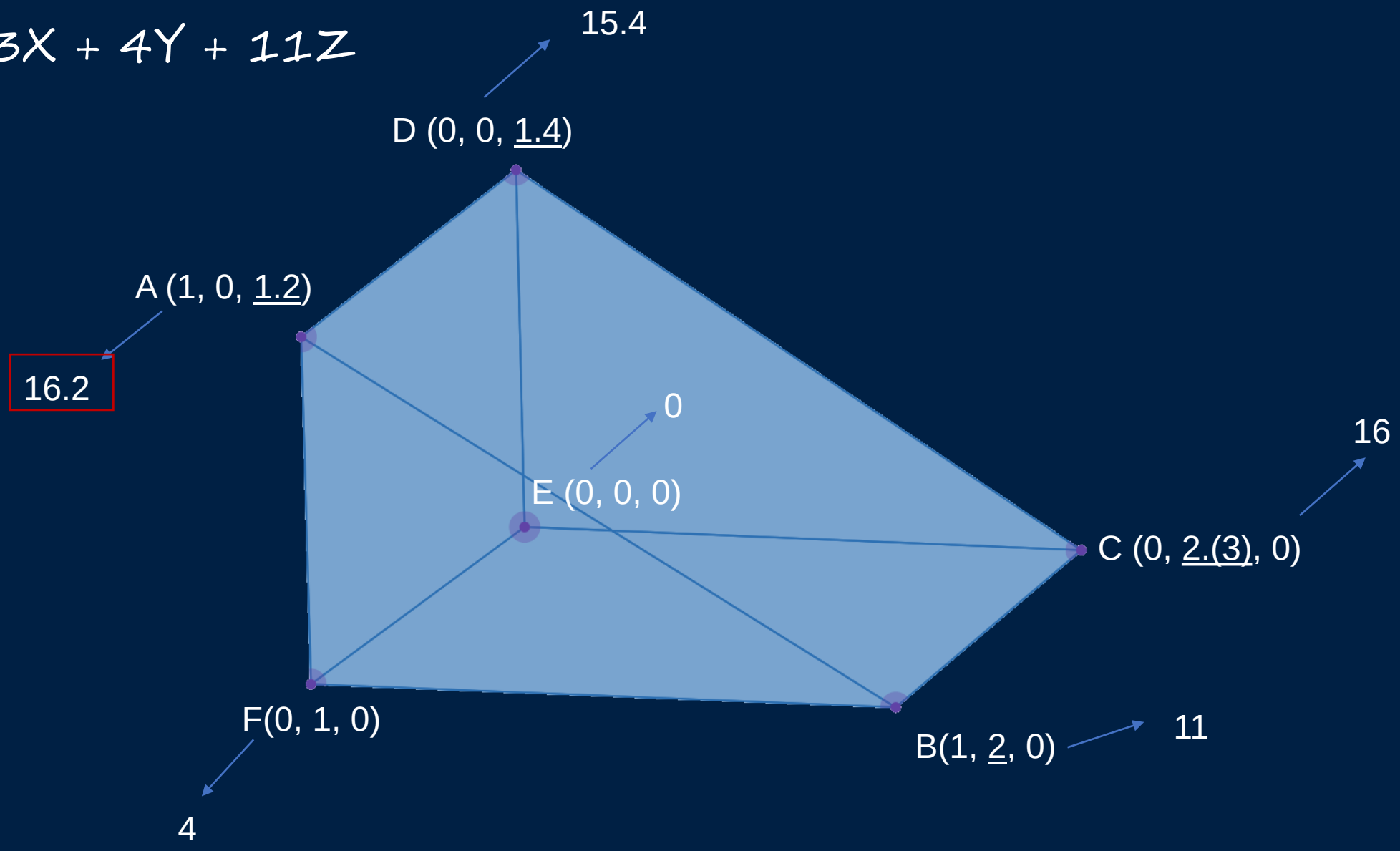
$$MAX\ 3X + 4Y + 11Z$$

$$X + 3Y + 5Z \leq 7$$
$$X \leq 1$$
$$X \geq 0$$
$$Y \geq 0$$
$$Z \geq 0$$

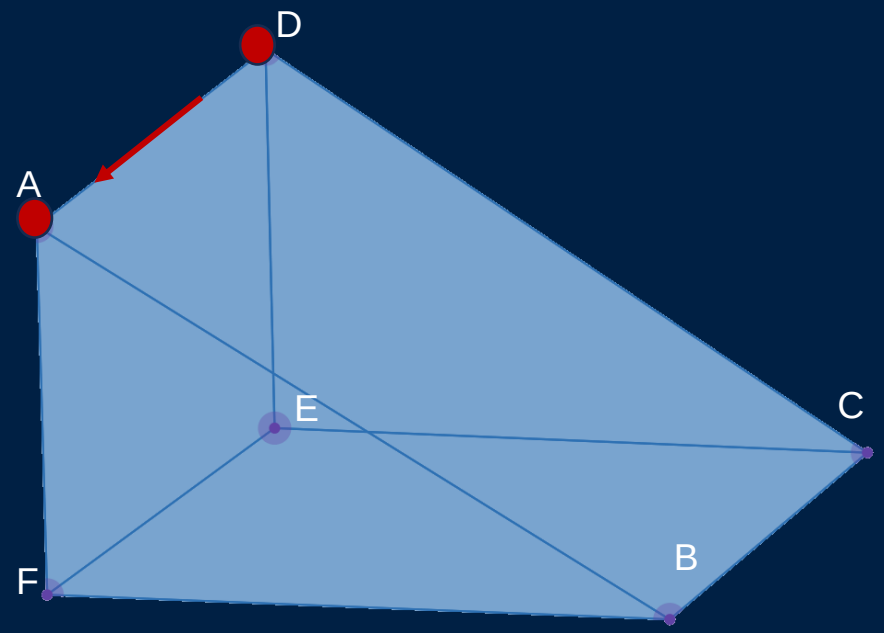

Z
X + 3Y + 5Z ≤ 7
0 ≤ X ≤ 1
C
D
A
B
X
Y

Business Use

MAX 3X + 4Y + 11Z



Simplex



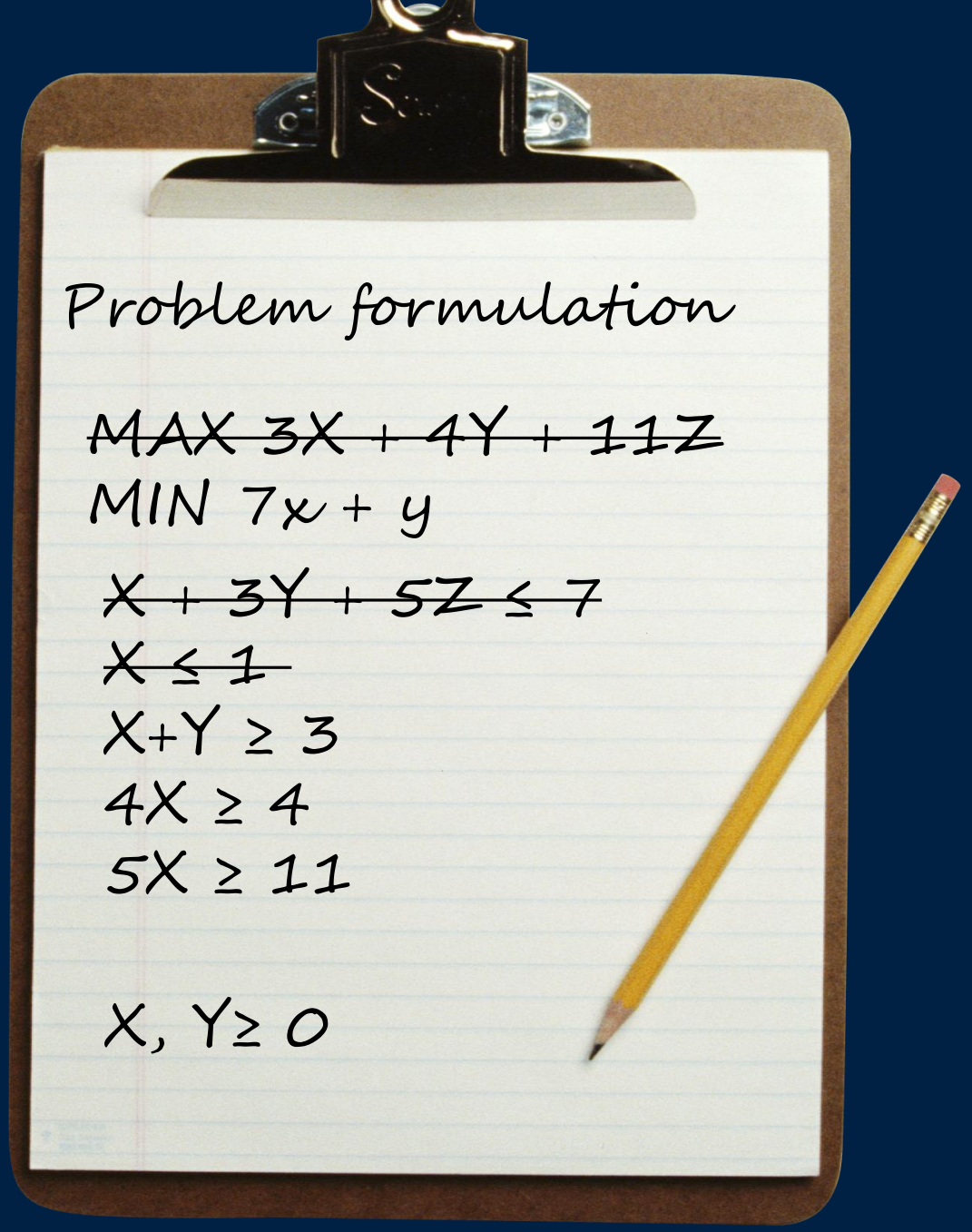
Solved in two iterations!

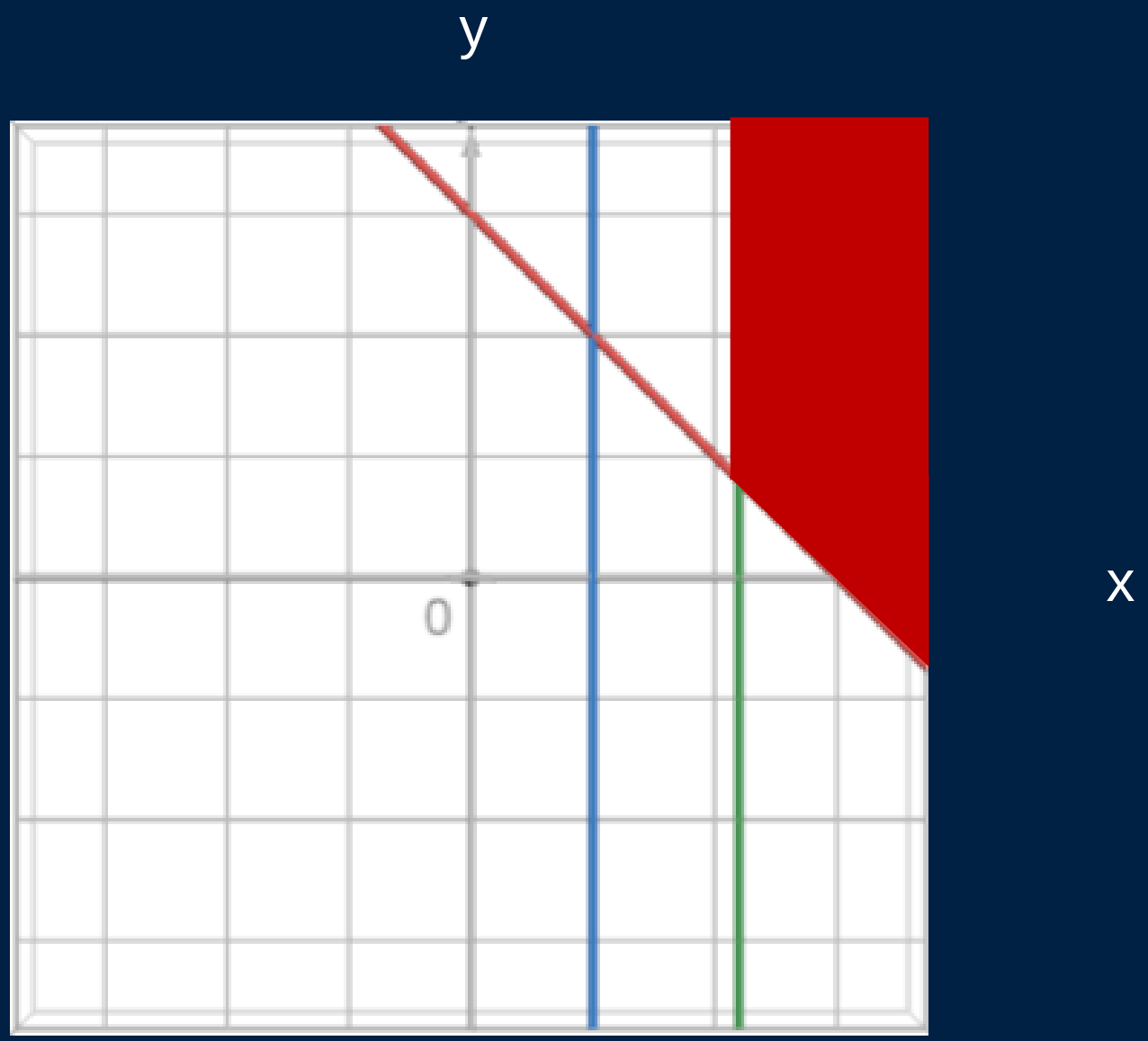
D (0, 0, 1.4)

Table 2	C_j	3	4	11	0	0	
C_b	Base	X_1	X_2	X_3	S_1	S_2	R
11	X_3	1/5	3/5	1	1/5	0	7/5
0	S_2	**1**	0	0	0	1	1
	Z	-4/5	13/5	0	11/5	0	77/5

A (1, 0, 1.2)

Table 3	C_j	3	4	11	0	0	
C_b	Base	X_1	X_2	X_3	S_1	S_2	R
11	X_3	0	3/5	1	1/5	-1/5	6/5
3	X_1	1	0	0	0	1	1
	Z	0	13/5	0	11/5	4/5	**81/5**


Problem formulation
MAX 3X + 4Y + 11Z
MIN 7x + y
X + 3Y + 5Z ≤ 7
X ≤ 1
X+Y ≥ 3
4X ≥ 4
5X ≥ 11
X, Y≥ 0


y
x
0

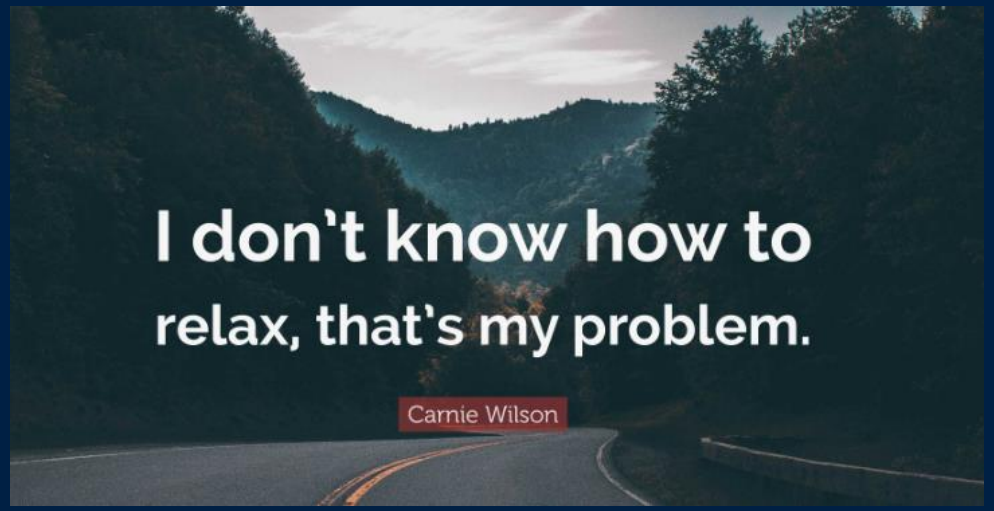
1 0 1.2

~~Fractional Knapsack Problem~~

↓

Bounded Knapsack Problem

From linear programming to integer linear programming



Problem relaxation

Simplex, Graphical method

Problem formulation

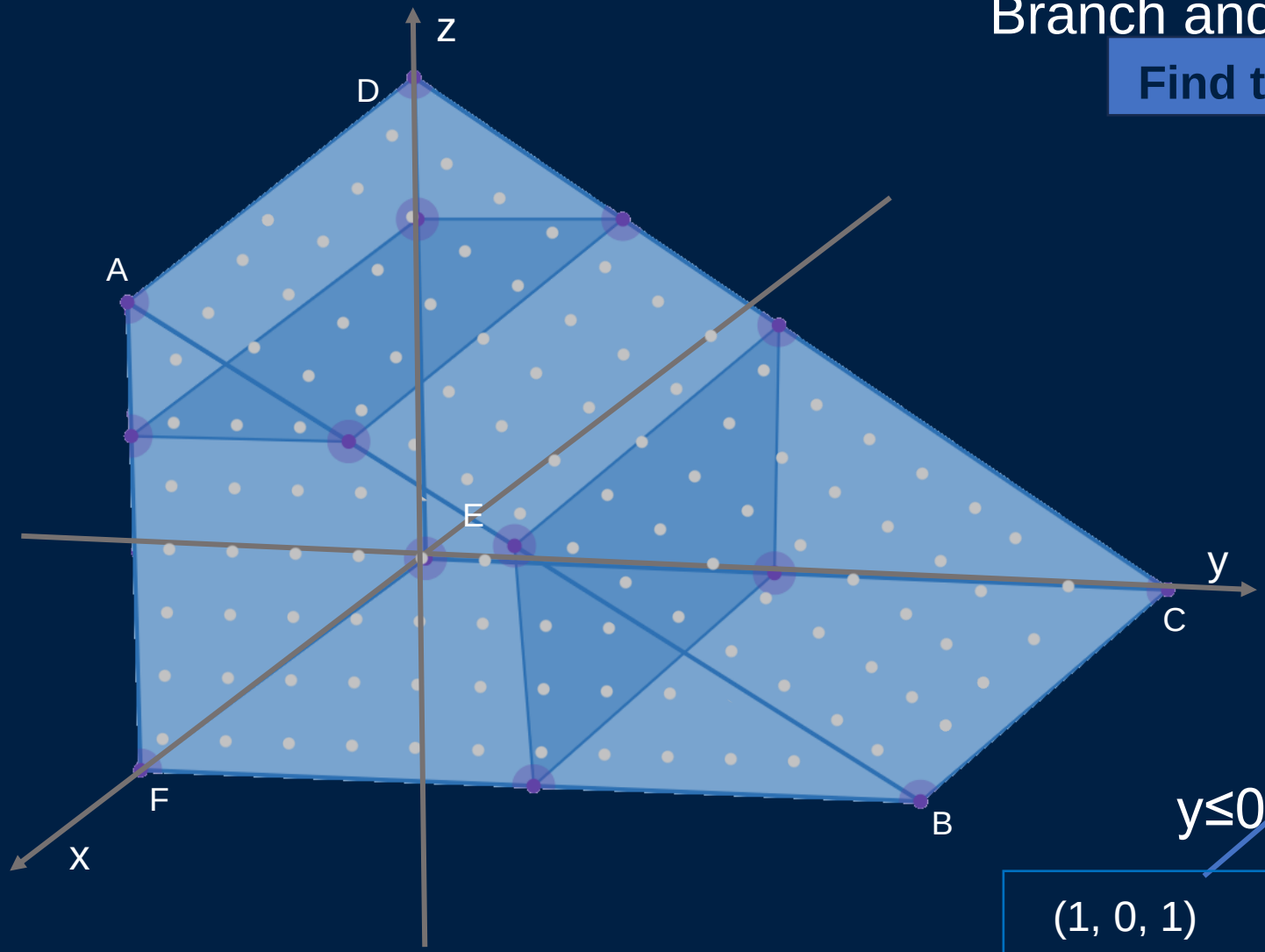
$$MAX\ 3X + 4Y + 11Z$$

$$X + 3Y + 5Z \leq 7$$
$$0 \leq X \leq 1$$
$$Y \geq 0$$
$$Z \geq 0$$

Z,Y,X are integer

Branch and bound

Find the best integer solution



A (1, 0, 1.2)
16.2

z≤1

z≥2

(1, 0.(3), 1)
LB=15.(3)

infeasible

Sub-linear problems

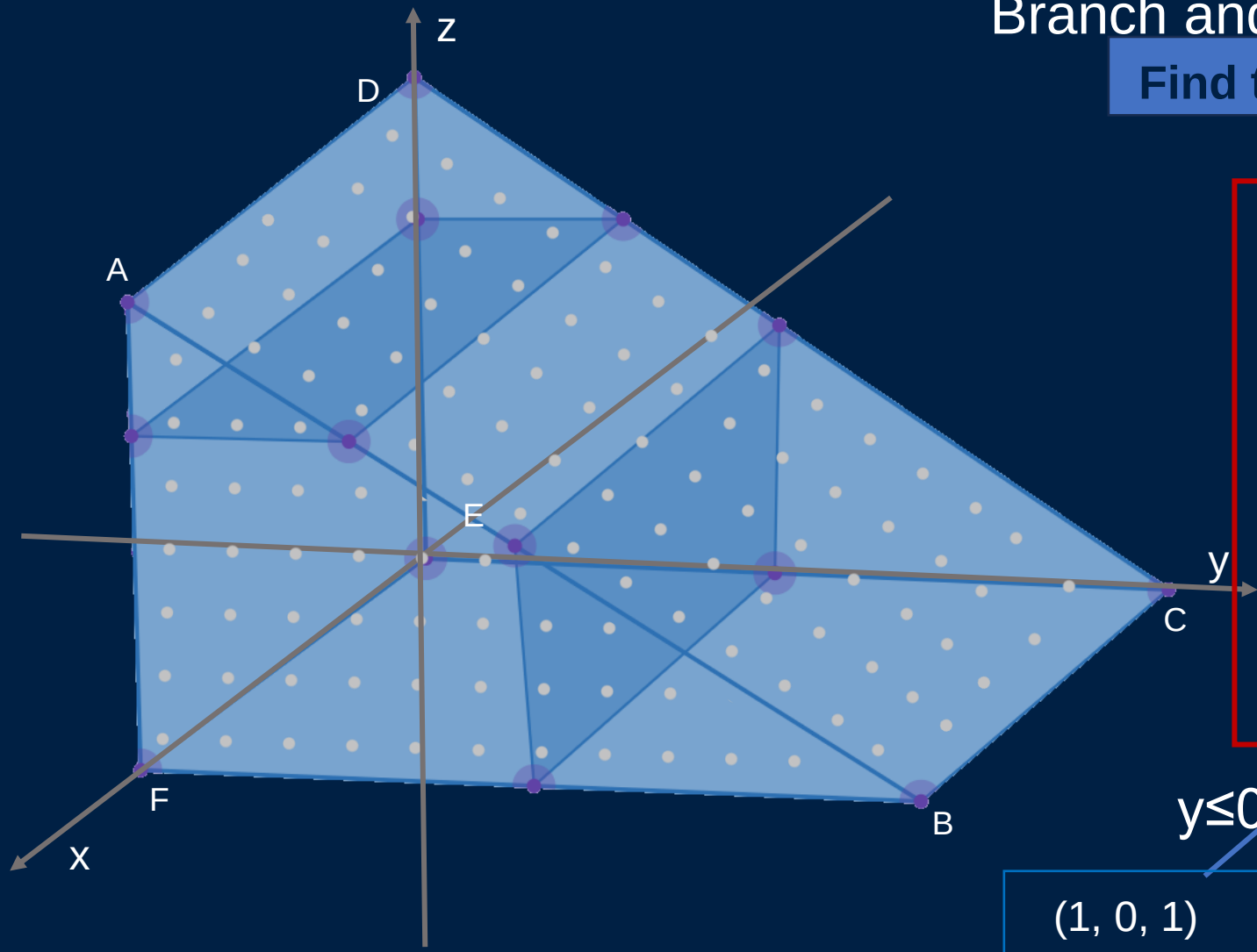
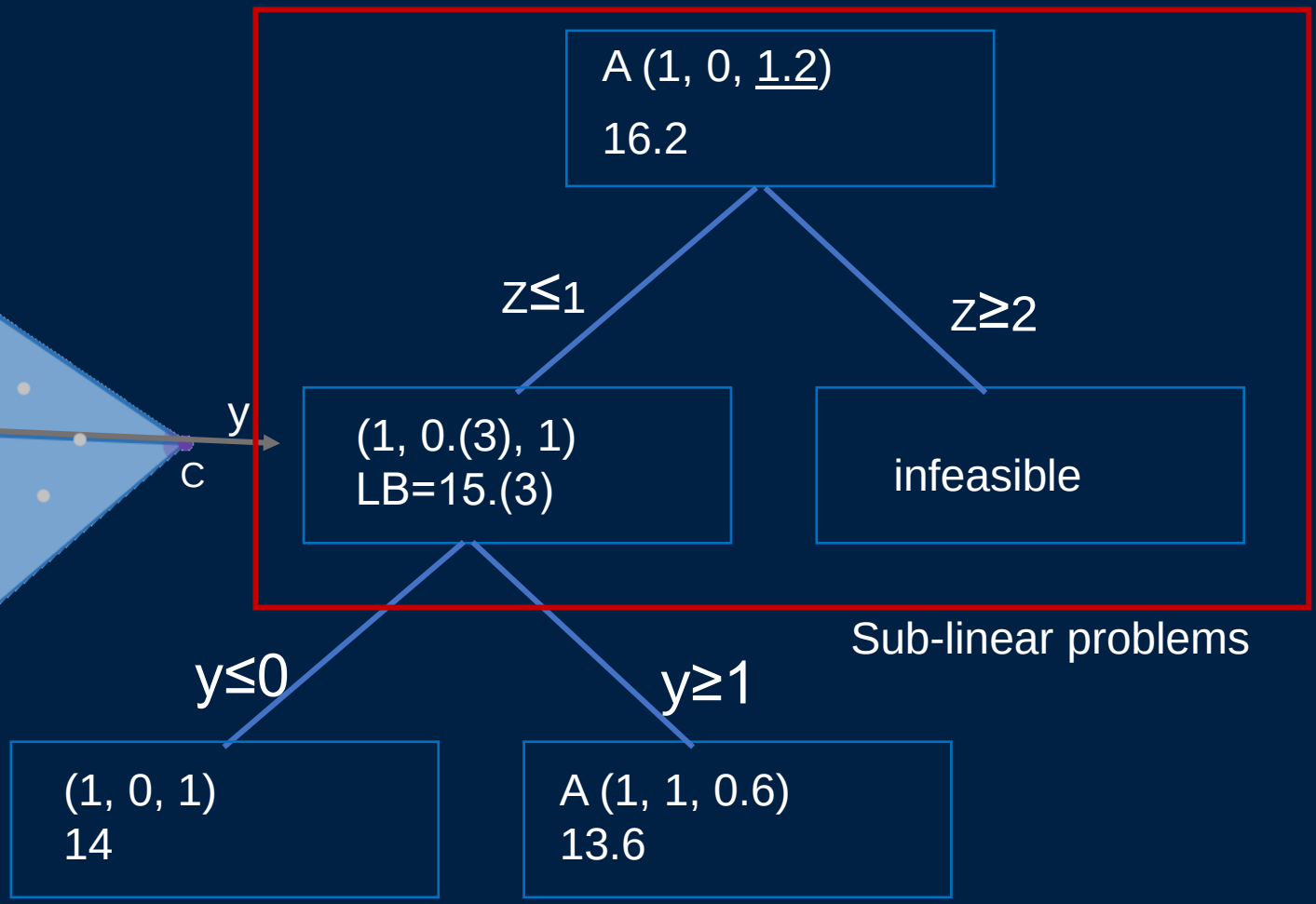
y≤0

y≥1

(1, 0, 1)
14

A (1, 1, 0.6)
13.6

From integer linear programming to mixed integer linear programming

Branch and bound

Find the best integer solution