

Optimization in Finance – Problem set 3

3.1 Use the graphical method to solve the following LP problems:

- (a) max. $3x_1 + 4x_2$ subject to $3x_1 + 2x_2 \leq 6$, $x_1 + 4x_2 \leq 4$, $x_1 \geq 0$, $x_2 \geq 0$.
- (b) max. $2x_1 + 5x_2$ subject to $-2x_1 + 3x_2 \leq 6$, $7x_1 - 2x_2 \leq 14$, $x_1 + x_2 \leq 5$, $x_1 \geq 0$, $x_2 \geq 0$.
- (c) max. $8x_1 + 9x_2$ subject to $x_1 + 2x_2 \leq 8$, $2x_1 + 3x_2 \leq 13$, $x_1 + x_2 \leq 6$, $x_1 \geq 0$, $x_2 \geq 0$.

3.2 The region A consists of all (x_1, x_2) satisfying $-2x_1 + x_2 \leq 2$, $x_1 + 2x_2 \leq 8$, $x_1 \geq 0$, $x_2 \geq 0$.

Solve the following problems with A as the feasible region:

- (a) max. x_2
- (b) max. x_1
- (c) max. $3x_1 + 2x_2$
- (d) min. $2x_1 - 2x_2$
- (e) min. $-3x_1 - 2x_2$

3.3 Charlie's Chocolate Factory has 210 kilos of cocoa and 150 kilos of milk powder. The chocolatier decides to make two different chocolates. Premium chocolate will contain 70% cocoa and 30% milk powder and will sell for €40 per kilo. Standard chocolate will contain 50% cocoa and 50% milk powder and will sell for €30 per kilo.

- (a) Formulate a linear programming model to maximize the sales revenue of the factory.
- (b) Plot the constraints and identify the feasible region on a graph.
- (c) How many kilos of each chocolate should the factory produce in order to maximise the sales revenue? Calculate the sales revenue for the optimal solution