Lecture 19: Examples

MA208 Quantitative Techniques for Business

Ilia Pirashvili, PhD

With special thanks to Dr. Kirsten Pfeiffer

School of Mathematical and Statistical Sciences
University of Galway

March 25, 2024

Corner Point Method

To solve a linear programming problem with two decision variables:

1. Graph the region satisfying all of the inequalities. This is called region of feasible solutions.
2. Find the co-ordinates of all of the corner points of the region.
3. Substitute each into the function to be maximised.
4. One of these is the answer!

Note: To solve linear programming problems with more than two variables, more advanced methods are required, for example the "Simplex Method".

Example 1

Example

The annual subscription for a tennis club is €20 for adults and €8 for juniors. The club needs to raise at least €800 in subscriptions to cover its expenses.
The total number of members is restricted to 50. The number of junior members is to be between one quarter and one third of the number of adult members.

(i) Represent this problem graphically.

(ii) Find the number of adults and junior members which will bring the largest amount of money in subscriptions.

Example 2

Example (from 2015 exam paper)

(a) You are invited to play a game in which five fair coins are tossed in a fair way. Denote by X the number of heads that the five coins show together. What is the probability that

(i) $X = 0$,
(ii) $X = 1$,
(iii) $X = 2$,
(iv) $X = 3$,
(v) $X = 4$,
(vi) $X = 5$?

(b) You win $€ X + X^2$ if an even number of the coins show heads, and you lose $€ X + X^2$ if an odd number of them show heads.

What are your expected winnings in this game?

(c) Assume that the oil depot near Dublin harbor imports oil from Russia and pays in rubles at the arrival of the tank ship.

In order to hedge against the fluctuation of the ruble exchange rate, the oil depot buys stock options of Russian companies throughout the year, and sells them when the rubles for the incoming merchandise are needed.

The shareholder value of the three companies selected by the oil depot, namely Gazprom, Norilsk Nickel and Aeroflot, also depends on the ruble exchange rate.

Due to the different business fields the prices change in different ways summarized in the following table (in € per share).

Ruble exchange rate	Norilsk Nickel	Gazprom	Aeroflot
Sinking	€ 150	€ −20	€ 20
Rising	€ 20	€ 130	€ 30
Stagnating	€ −50	€ −10	€ 52

Assume probabilities of 20% for a sinking, 20% for a rising and 60% for a stagnating ruble exchange rate.

(i) Which of the three stock options will give the maximum expected shareholder value?
Explain your answer by calculating the expected shareholder value of all three stock options (in € per share).

(ii) What would be the value (in € per share) for the oil depot to know the development of the ruble exchange rate in advance?