Linear Programming

Introduction

One of the oldest and most frequent questions within mathematics is *‘What is the best solution to a problem’.* Ideally there will be a singular *best* solution, but occasionally, a problem can give rise to a number of *feasible* solutions.

One example of this could be the quickest way to get from *A* to *B* given that there is more than one route or the best way to manufacture a number of products having a limited number of resources. Problems of this type are known as *optimization problems*.

This area of mathematics was explored by mathematicians during the Second World War. Many mathematicians, including the American Albert W. Tucker were enlisted by the US war department to help maximise the Materials and Human Resources of the war effort. Albert W. Tucker became a notable mathematician in this field.

Interestingly, ‘*Linear Programming’* has little to do with computer programs other than the logical approach to solving a problem. Most *constraints* present themselves as linear equations and individual work conducted by mathematicians to maximising the war resources was known as *programs*.

Constraints

From the earlier example, the shortest route from A to B may not always be the quickest as there may be many factors to consider. These factor/s we will learn later are called ‘*constraints*’ and play a vital role in the mathematical solution to linear programming. Constraints play a limiting role in a problem, for example;

* The manufacture of a certain type of shoe maybe limited to 500 because the numbers sold never exceed 500, however another style of shoe, sales exceeds manufacturing capacity and will not have this constraint.

It worth mentioning that linear program solutions present a numerical solution to a problem, but until implemented may be less than idea.

Variables

These are the items and resources available. We will do well to remember that there are no *negative* variables in linear calculations.

Graphical solutions

It will come as no surprise that for *some* linear programming problems, solutions to these problems will be found using graphical methods. However, plotting more than two outcomes will not be possible using a two dimensional graph i.e. X and Y, but a great deal of relatively complex linear problems can be solved using graphical means. Practice in converting programs into a linear format so they maybe plotted upon a graph will be very important.

For example:

A factory manufactures two types of telephone:

Telephone x is sold for €42 and the total manufacturing cost is €30

Telephone y is sold for €19 and its total manufacturing cost s €17

Together the profit from both of these telephones could be mathematically written as:

12x+2y = profit

As we can see, this could be represented graphically. This will form part of a linear solution process.