Further Mathematics Unit 4

Graphs and relations module sample learning activity – constraints, regions and objectives

Introduction

This activity explores setting up and solving problems in contexts that are amenable to linear programming. Sample contexts can be obtained from various sources such as: <http://www.cimt.org.uk/projects/mepres/alevel/discrete_ch5.pdf> and <https://www.math.ucla.edu/~tom/LP.pdf> . Students should use technology as applicable to solve problems.

Part 1

Consider a context for which a linear programming solution has been obtained. For this context clearly identify:

1. variables and constraints
2. the feasible region and its boundaries
3. the objective function and solutions for maximum and minimum values

Can a solution to the problem lie outside the feasible region? Is there only one solution to a problem? When should the solution have integer values?

Part 2

Being able to formulate a set of inequalities to define constraints and identify a feasible region is an important part of the linear programming process. Use various sets of constraints and contexts to:

1. formulate sets of inequalities
2. construct feasible regions and draw graphs of these
3. verify when points are inside, outside, or on the boundary of the feasible region for these contexts

Part 3

Consider graphs of various feasible regions. For each of these:

1. formulate a set of constraints that produce a given feasible region
2. determine the coordinates of the corner points
3. identify the points with integer coordinates in the feasible region

Part 4

Consider various objective functions for a given feasible region or collection of feasible regions. Use both sliding line and corner point methods to:

1. find the minimum value of each of the objective functions and the coordinates of the corresponding points
2. find the maximum value of each of the objective functions and the coordinates of the corresponding points
3. use a linear programming solver to check your solutions such as: <http://www.excel-easy.com/data-analysis/solver.html> or <http://www.wolframalpha.com/widget/widgetPopup.jsp?p=v&id=1e692c6f72587b2cbd3e7be018fd8960&title=Linear%20Programming%20Calculator&theme=blue>

Areas of study

The following content from the areas of study is addressed through this task.

|  |  |
| --- | --- |
| **Area of study** | **Content dot points** |
| Module – Graphs and relations : *Linear programming* | 1, 2, 3, 4, 5 |

Outcomes

The following outcomes, key knowledge and key skills are addressed through this task.

|  |  |  |
| --- | --- | --- |
| **Outcome** | **Key knowledge dot point** | **Key skill dot point** |
| **1** | 6, 7, 8, 9 | 7, 8 |
| **2** | 1, 2, 3, 4 | 1, 2, 3, 4 |
| **3** | 2, 3, 4 | 5, 6, 8, 9 |