3.2 Apply linear programming methods in solving problems

Rods and Pillars Credits: 3

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| Achievement | Achievement with Merit | Achievement with Excellence |
| Apply linear programming methods in solving problems. | Apply linear programming methods, using relational thinking, in solving problems. | Apply linear programming methods, using extended abstract thinking, in solving problems. |

Introduction

Ace Machine Company produces machine parts called rods and pillars for the construction industry.

This activity requires you to use linear programming to model the constraints the company has for the production of the rods and pillars and to make recommendations about the optimum mix of these two machine parts and whether the hours available for drilling and grinding should be increased. You will present your findings as a written report supported by graphs, equations, and relevant calculations. The quality of your thinking and how well you link this to the context will determine the overall grade.

Task

Ace Machine Company wants to maximise the profit it makes from making rods and pillars. Producing these parts requires drilling, grinding, and polishing. The company is considering to adjust the profit it makes from rods and pillars.

Using the constraints outlined in Resource A, write a report recommending the number of rods and pillars the company should produce each week and the number of hours of drilling and grinding it should have available. Your report needs to answer the following questions:

* How many rods and pillars should Ace Machine Company produce to maximise profit without increasing hours?
* How would the changes in rods’ and pillars’ profit affect the optimum mix of these two machine parts?
* Is it profit-effective to change the profit of the rods and pillars?

As you write your report, take care to clearly communicate your findings using appropriate mathematical statements. Include graphs, equations, and relevant calculations.

Resource A

Ace Machine Company produces two types of machine parts (rods and pillars) for the construction industry. Note that:

* Rods bring in a profit of $300 each. Pillars are more profitable, bringing in a profit of $600 each, so the company’s profit ($P) each week is given by the equation P = 300*r* + 600*p*, where *r* is the number of rods sold and *p* is the number of pillars sold.
* Market conditions mean that the company can sell at most 60 rods and 70 pillars each week. These constraints can be written *r* ≤ 60 and *p* ≤ 70.
* The company can provide:
* 105 drilling hours per week – each rod requires half an hour of drilling and each pillar requires one-and-a-half hours of drilling.
* 90 hours of grinding per week – each rod requires one hour of grinding and each pillar requires one hour of grinding
* 70 hours of polishing per week – each rod requires one hour of polishing and each pillar requires half an hour of polishing.
* The company is considering to bring in the same profit of $450 each rod and pillars. (P = 450*r* + 450*p* )