**Exercises sheet 1**
**School of Mathematics**
**The University of Edinburgh**
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Exercise 1 is for you to test that you can both model and solve small linear programs that you can do on your own. If you have any questions, please ask in the Forum. Exercise 2 is a group exercise: We want you to model the problem in writing. You will discuss your model with your fellow students in the group before you implement it.

## **Exercise 1** *Model+Solve*

A farmer owns 45 acres of land. He is going to plant each with wheat or corn. Each acre planted with wheat will yield £200 profit, while each acre with corn will yield £300 profit. The labor and fertilizer used for each acre are given in the table below. 100 workers and 120 tonnes of fertilizer are available. How can the farmer maximize his profit?

| | Wheat | Corn |
|---|---|---|
| Labor (workers) | 3 | 2 |
| Fertilizer (tonnes) | 2 | 3 |

## **Exercise 2** *Model*

John has a very particular diet. He requires that all the food he eats come from one of the four "basic food groups" (chocolate cake, ice cream, soda and cheesecake). At present, the following four foods are available for consumption: brownies, chocolate ice cream, cola, and pineapple cheesecake. Each brownie costs 50p, each scoop of chocolate ice cream costs 20p, each bottle of cola costs 30p, and each piece of pineapple cheesecake costs 80p. Each day, John must ingest at least 500 kcal, 6 ounces of chocolate, 10 ounces of sugar, and 8 ounces of fat. Given the nutritional content in the table below, formulate the linear programming model that satisfies his daily nutritional requirements at minimum cost. Solve this model with Xpress initializing the data from a file.

| Type of food | Energy (kcal) | Chocolate (oz) | Sugar (oz) | Fat (oz) |
|---|---|---|---|---|
| Brownie | 400 | 3 | 2 | 2 |
| Chocolate ice cream (scoop) | 200 | 2 | 2 | 4 |
| Cola (bottle) | 150 | 0 | 4 | 1 |
| Pineapple cheesecake (piece) | 500 | 0 | 5 | 5 |

## **Exercise 3** *Model*

ScotFoods blends olive, corn and sunflower oils to manufacture cooking and salad oils. The proportions of each type of oil in each product, the supply of each type of oil and the selling

price of each product are given in the tables below (prices in sterling pounds, weights in tonnes). What is the production planning that maximizes the selling benefits? Assume that all the production is sold.

| Product | Olive | Corn | Sunflower | Price (£/t) |
|---|---|---|---|---|
| Cooking oil | 0.2 | 0.4 | 0.4 | 600 |
| Salad oil | 0.5 | – | 0.5 | 900 |

| | Olive | Corn | Sunflower |
|---|---|---|---|
| Supply (t/day) | 200 | 180 | 300 |