Using Lindo to solve problems
(http://www.lindo.com)

The aim of this laboratory session is to solve linear models using lindo and to interpret the solutions obtained.

1. A family involved in ecological agriculture has a small jam production. This year they have collected 1000kg of apples, 600 kg of plums and 800 kg of peach. The cost generated by each kg of fruit collected is the following: apple 0.40 euro/kg, plum 0.60 euro/kg and peach 0.80 euro/kg.

   By using the fruit collected, they produce these kinds of jam:

   - One flavour jam: apple-jam, plum-jam, peach-jam.
   - Two flavours jam: apple and plum jam, apple and peach jam.

   1kg of jam is obtained from each kg of fruit. Fruit is mixed fifty-fifty in the two flavours jams.

   The jam is sold to a delicatessen shop, at the price of 2 euros each one flavour jam kg, and at the price of 2.5 euros each two flavours jam kg. The shop demands to receive the following minimum quantity of one flavour jam: 175 kg apple-jam, 160 kg plum-jam and 150 kg peach-jam.

   The shop does not demand a minimum amount of two flavours jam, but is ready to buy any quantity offered by the family. The family aims to maximize the benefit obtained from the jam production.

   1.1 Formulate a linear model to represent the problem.

   1.2 Solve the linear model.

   1.3 How many kg of each type of jam will be produced?

   1.4 What do the slack variables represent?

   1.5 For each of the components in vector **c**, find the range of values that leaves the current basis unchanged.

   1.6 Write the corresponding dual model, and extract the optimal solution to the dual problem directly from the optimal tableau computed for the primal problem.

   1.7 Interpret the shadow prices, and verify their effect in the objective value.

2. Children living in a city intend to enjoy their summer in one of the two summer camps near the city. Summer camp S_1 is 8 km away and summer camp S_2 26 km away. It has to be guaranteed that all children will be accepted either in one summer camp or in the other. If possible, they all prefer to go to the nearest one.

Children whose mother tongue is Basque are majority among all the children, as it can be seen in the table:

Mother tongue	Children
Basque	650 girls, 600 boys
Spanish	475 girls, 475 boys

It must be guaranteed that the majority of the children going to each summer camp will be girls and that the mother tongue of the majority of them will be Basque. In summer camp S_1 there is no place for more than 800 children.

2.1 Formulate a linear model to represent the problem.

2.2 Solve the linear model.

2.3 What will be the distribution of children in the two summer camps?

2.4 For each of the components in vector **c**, find the range of values for which the distribution of the children will remain unchanged. Do the same analysis for each of the components in vector **b**.

2.5 Write the corresponding dual model, and give the optimal solution for it.