Optimization Models and Applications

Homework #1

Due date: 09/09/2014, 9.20am

1. A blending problem [20 points]

1.1 The problem

A petroleum company blends oil fractions F_1 and F_2 to make products P_1 and P_2.

The product P_1 is a blend of F_1 and F_2 in the ratio $3:7$ and sells for $\$8/\text{tonne}$.

The product P_2 is a blend of F_1 and F_2 in the ratio $1:1$ and sells for $\$10/\text{tonne}$.

The company has 120 tonnes of F_1 and 210 tonnes of F_2. How many tonnes of P_1 and P_2 should be made in order to maximize revenue?

1.2 Tasks

- Define the optimization variables [1 point]
- Define objective function [2 points]
- Define constraints [2 points]
- Write the optimization problem [3 points]
- Solve the problem using graphical method [3 points]
- Solve the problem using Excel [4 points]
- Solve the problem using Ampl (show the model/data file) [5 points]

2. Convex functions [5 points]

2.1 Function 1 [1 point]

Is function $f(x) = 5x_1 - 10x_2$ convex?

2.2 Function 1 [2 point]

Is function $f(x) = e^{x_1} + 7x_2$ convex?

2.3 Function 1 [2 point]

Is function $f(x) = \log(x_1) + 7x_2$ convex?