Solutions to Attendance Quiz for Lecture 3

1. Set up a linear programming model of the situation described. Determine whether it is in standard form. If not make it standard.

A restaurant chef is planning a meal consisting of two foods, A, and B.

• Each kg of A contains 3 units of fat and 6 units of protein

• Each kg of B contains 1 unit of fat and 3 units of protein

The chef wants the meal to consist of at least 18 units of protein and at most 6 units of fat.

If the profit that he makes is 3 dollars per kg for food A and 5 dollars for food B, how many kilograms of each food should be served so as to **maximize** his profit?

Solution to 1.

Let x_1 be the amount in kilograms that the chef makes of food A, and let x_2 be the amount in kilograms that the chef makes of food B.

• The total amount of fat is $3x_1 + x_2$ units.

• The total amount of protein is $6x_1 + 3x_2$ units.

Since the total amount of fat in the two foods is $3x_1 + x_2$ units , and it may not exceed 6, the first constraint it $3x_1 + x_2 \leq 6$.

Since the total amount of protein in the two foods is $6x_1 + 3x_2$ units , and it must be at least 18 units, the second constraint it $6x_1 + 3x_2 \geq 18$.

The **profit** is $3x_1 + 5x_2$.

The **Mathematical model** is

Maximize $z = 3x_1 + 5x_2$

subject to the constraints (or restrictions)

$$3x_1 + x_2 \leq 6 \quad ,$$

$$6x_1 + 3x_2 \geq 18 \quad ,$$

$$x_1 \geq 0 \quad , \quad x_2 \geq 0 \quad .$$

This is **not** in standard form, since the second constraint has a "$\geq$" rather than a "$\leq$". To remedy it, we multiply both sides by -1, and of course change the "$\geq$" to "$\leq$".

The **standard** form of the same linear programming problem is

Maximize $z = 3x_1 + 5x_2$

subject to the constraints (or restrictions)

$$3x_1 + x_2 \leq 6 \quad ,$$

$$-6x_1 - 3x_2 \leq -18 \quad ,$$

$$x_1 \geq 0 \quad , \quad x_2 \geq 0 \quad .$$