Brick Production

Parts:

1. Cement   C1
2. Clay   C2

Raw Materials:

1. Silicon Oxide   P1
2. Calcium Oxide   P2

A brick producing enterprise, produces bricks made of special ingredients. The product has applications in dwellings and various commercial, industrial and institutional buildings. A brick is composed of the two parts: cement (C1) and clay (C2), which are cast using the means of products i.e. silicon oxide (P1) and calcium hydroxide (P2) .

In order to minimize the costs of manufacturing, the enterprise limited the availability of the components of brick mass to 56 units of P1 and 54 units of P2.

In order to manufacture the cement for one brick it is necessary to have 8 units of silicon oxide and 9 units of calcium hydroxide and 7 and 6 units, respectively, in the case of the clay. Manufacturing of one brick necessitates 5 units of C1 and 4 units of C2. The cost of unit production is not high, however, as a result of high contribution of defects, the finished products are added a high profit margin. Before the process of manufacturing was started, it was estimated that the production will reach break-even point at the level of sales of 10 pieces. In consideration of the planned production, the enterprise set and assessed the achievement of operating objectives by means of multi-criteria optimization. These objectives assumed:

Q1 Calculate the minimum investment expenditures for production of one piece of product P, with the unit costs of producing being 1.5 cash units for cement and 3.5 units for clay.

Q2. Calculate the maximum profit per product sale with the value of individual components of C1 and C2 at the level of 9 cash units and 7 cash units.

Q3. minimize the manpower in production division shifts, with 3 people at each shift participating in manufacturing of cement and 2 people making casts of clay.

These objectives were listed according to the degree of importance; however, it is known that not all of them can be equally achieved. Definition of decision variables in the form of: x_1 – level of production of the product C1 and x_2 – level of production of the product C2 and, in consideration of the constraint of availability of means of production, the following system of inequalities was obtained:

$8x_1 + 7x_2 \leq 56$
$9x_1 + 6x_2 \leq 54$
$5x_1 + 4x_2 \geq 10$

Objective Id
1 $1.5x_1 + 3.5x_2$
2 $9x_1 + 7x_2$
3 $3x_1 + 2x_2$