Example 0.1 Consider a product mix problem in which there are 3 basic products (P_1, P_2, P_3) and 2 premium ones (P_4, P_5). There are 3 machines (A, B, and C) that are used to make the products. Every product must be handled by all the 3 machines. The following table reports the minutes needed for 1000 g of any product on any machine, and the minutes available for any machine.

	P_1	P_2	P_3	P_4	P_5	minutes available
A	100	150	120	300	280	3500
B	180	160	110	300	290	4200
C	130	150	120	290	430	4300

Any produced quantity q_i must not exceed the upper bound u_i. At least 10000 g of basic products, and at least 3000 g of premium products must be manufactured. The utility of any product i is equal to 0 if the produced quantity $q_i = 0$, otherwise, it is equal to $p_i q_i - F_i$ if $q_i > 0$.

	P_1	P_2	P_3	P_4	P_5
u	6000	6000	6000	4000	4000
p	3	16	10	60	65
F	130	500	450	1000	1400

The product mix must satisfy either the following constraints:

- The produced quantity of P_1 must be at least the 25% of the total production.
- The quantity of premium products must be at least 80% of that of basic products.

or the following constraints:

- The produced quantity of P_4 cannot exceed 1000 g.
- The produced quantity of P_3 cannot be less than 5000 g.

Maximize the utility by deciding the production quantity of any product.

Example 0.2 Assume that the quantities q can be greater than the upper bounds u. But if $q_i > u_i$ then a penalty F_i^2 in the utility occurs.

	P_1	P_2	P_3	P_4	P_5
F^2	2000	2000	1000	3000	2000

Maximize the utility by deciding the production quantity of any product.