

ISYE 3133 Project 3

Rohan Bhagat

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Non-Decision Variables

P = # of types of products.

M = # of types of materials.

p_i = the sale price of product i , $0 \leq i < P$

a_j = the amount of material j available, $0 \leq j < M$

$r_{i,j}$ = the amount of material j required to produce 1 unit of product i ,
 $0 \leq i < P, 0 \leq j < M$

Decision Variables:

x_i = the amount of product i to produce, $0 \leq i < P$

Objective Function:

$$\max\{\sum_{i=0}^{P-1} x_i p_i\}$$

Constraints:

$$\sum_{i=0}^{P-1} x_i r_{i,j} \leq a_j, \forall j$$

Part I, section c)

Our optimal solution involves selling non-zero quantities of Products 0, 3, 6, 9, 14, 18, 22, 23, 25, 27, and 30.

If, in addition to the products produced and sold in the optimal solution, 1 unit of product 1 (the second product, since our product numbering is 0-indexed) were sold, the objective value would increase by 3, since the product price of

product 1 is 3. In reality, we would only be able to do this if we were able to relax our constraints by increasing material availability.

Part II

a) The resource cost of the new product is $rc_{New} \approx \$4.57$. This means that if we were to produce 1 unit of this product, it would 'cost' us $rc_{New} \approx \$4.57$ in opportunity cost to produce. So, this can be thought of as the minimum price our product must sell for in order for it to be worth producing.

b) The objective value does not change because the resource cost of the new product is greater than its sale price. Therefore, it is not optimal to choose to produce this product, even if we are able to, and so our optimal production does not change from Part I to Part II.

c) Here the objective value increases because we are able to sell our new product for a price greater than the opportunity cost of the materials it requires (resource cost). Therefore, it is optimal for us to produce this product when possible (up to a certain point). By making this product available to sell in Part II, we are able to produce it in Part II, increasing our revenue and thus our objective value.