**Question**

A certain corporation has three branch plants with excess production capacity. All three plants have the capability for producing a certain product, and management has decided to use some of the excess production capacity in this way. This product can be made in three sizes -- large, medium, and small -- that yield a net unit profit of $385, $330, and $275, respectively. Plants 1, 2, and 3 have excess labor and equipment capacity to produce 750, 900, and 450 units per day of this product, respectively, regardless of the size or combination of sizes involved. However, the amount of available in-process storage space also imposes a limitation on the production rates. Plants 1, 2, and 3 have 13,000, 12,000, and 5,000 square feet of in-process space available for a day's production of this product. Each unit of large, medium, and small sizes produced per day require 20, 15, and 12 square feet, respectively. Sales forecast indicates that 900, 1200, and 750 units of the large, medium, and small sizes, respectively, can be sold per day. Management wishes to know how much of each of the sizes should be produced by each of the plants to maximize profit. Formulate the linear programming model for this problem. Solve the problem. Upload your R code, and any other files to your github account. In your submission, just write your github repository address.

**Formulating the linear programing problem**

Product X units can be produced at plant (1,2,3) of product size (L, M, S)

|  |  |  |  |
| --- | --- | --- | --- |
| Plant / Product | Large | Medium | Small |
| 1 | X1L | X1M | X1S |
| 2 | X2L | X2M | X2S |
| 3 | X3L | X3M | X3S |
| Profit per unit | $385 | $330 | $275 |

Maximum Profit Z = 385 (X1L + X2L + X3L) + 330 (X1M + X1M + X1L) + 275 (X1S + X2S + X3S)

X1L + X1M + X1S ≤ 750

X2L + X2M + X2S ≤ 900 Capacity constraint

X3L + X3M + X3S ≤ 450

20X1L + 15X1M + 12X1S ≤ 13000

20X2L + 15X2M + 12X2S ≤ 12000 Storage space constraint

20X3L + 15X3M + 12X3S ≤ 5000

X1L + X2L + X3L ≤ 900

X1M + X2M + X3M ≤ 1200 Product of each size sold per day

X1S + X2S + X3S ≤ 750

Change to equality

X1L + X1M + X1S \_ X2L + X2M + X2S = 0

750 900

X1L + X1M + X1S \_ X3L + X3M + X3S = 0

750 450

XPS (P=1,2,3; S= L, M, S) ≥ 0

Solved using R