Problem 3.1 : Storage server management

A company is running a video analytic system. To store the analyzed videos, the company has 10 local storage servers to store the data, of which each of them could store 24 TB per server. Recently, the company finds out that the servers they have will not be adequate in the recent future. Therefore, the company has to figure out a plan to scale up its resource. The CTO has come up with two solutions, which are buying new storage servers, and using a cloud storage service called 'SWA S3'. The cloud storage service charges 690 THB/TB per month. On the other hand, buying a new server costs 40,000 THB, but it could be used for a very long time. After several discussions, the company has projected the amount of storage required for each month. The projected data is shown in the table below. To minimize the cost, what should the company do to store the data? Formulate the problem as a linear program and solve for an optimal solution.

Note 1 : The optimal solution does not have to be an integer.

Note 2 : The company could buy new servers at any month.

Month	1	2	3	4	5	6	7	8
Estimated amount of storage required (TB)	140	200	300	1000	1400	500	600	900

Sets and Parameters

I = set of month = $\{1,2,3,4,5,6,7,8\}$

m_i = Estimated amount of storage required in month i ; $i \in I$

Decision variables

x_i = # cloud storage in month i ; $i \in I$

y = # Added server

Obj: $\min\left(690 \sum_{i=1}^{8} x_i + 40000y\right)$

s.t. $x_i + 24y + 1240 \geq m_i$; $\forall i \in I$ ⇒

$x_i, y \geq 0$; $\forall i \in I$

$x_1 + 24y + 1240 - s_1 = 140$ -100

$x_2 + 24y + 1240 - s_2 = 200$ -40

$x_3 + 24y + 1240 - s_3 = 300$ 60

$x_4 + 24y + 1240 - s_4 = 1000$ 760

$x_5 + 24y + 1240 - s_5 = 1400$ 1160

$x_6 + 24y + 1240 - s_6 = 500$ 260

$x_7 + 24y + 1240 - s_7 = 600$ 360

$x_8 + 24y + 1240 - s_8 = 900$ 660

From Colab,

The optimal soln is 1514000 baht