

# Operations Research I: Models & Applications

## Using Excel to Solve Nonlinear Programs

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## Complete formulation

- ▶ According to the previous videos, the parameter is

$R$  = minimum expected revenue.

- ▶ And the decision variables are

$x_i$  = shares of stock  $i$ .

- ▶ The variance of the total revenue is

$$100x_1^2 + 1600x_2^2 + 100x_3^2.$$

## Complete formulation

- ▶ To minimize the risk while ensuring a certain amount of expected revenue, the formulation of this example is

$$\begin{array}{llllllll} \min & 100x_1^2 & + & 1600x_2^2 & + & 100x_3^2 & & \\ \text{s.t.} & 50x_1 & + & 40x_2 & + & 25x_3 & \leq & 100000 \\ & 55x_1 & + & 50x_2 & + & 20x_3 & \geq & R \end{array}$$

with all variables nonnegative.

- ▶ Let's use the Solver add-in to find an optimal solution!

## Solve by the Solver add-in

- An optimal solution of this NLP is  $(1333.3, 833.3, 0)$ .  $z^* = 1288888889$ .

Stock	Price	Expected price	Bull market	Bear market	Variance of the price	Shares
1	50	55	65	45	100	1333.3
2	40	50	90	10	1600	833.3
3	25	20	30	10	100	0.0
			0.5	0.5		
	Minimum expected profit		115000			
	Budget		100000			
	Total spending	Expected profit	Sum of variance			
	100000	115000	1288888889			