



**VIRGINIA COMMONWEALTH UNIVERSITY**

**PRESCRIPTIVE ANALYSIS**

**ASSIGNMENT 2**

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**RE-SUBMITTED TO-**

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## Building a Financial Portfolio. Blair & Rosen, Inc.

### Problem

Blair & Rosen, Inc. is determining the optimal investment amounts for their client this week. The client can invest a maximum of \$35,000 in the Internet Fund and a total of up to \$50,000 across all investment options. The client's risk tolerance allows for a maximum risk rating of 240. The Internet Fund has a risk rating of 6 for every \$1,000 invested, while the Blue-Chip Fund has a risk rating of 4 per \$1,000 invested. The projected annual return is 12% for the Internet Fund and 9% for the Blue-Chip Fund.

	Internet Fund	Blue Chip Fund	Total
Budget			\$50,000
Annual Return	12%	9%	
Max investment	\$35,000		
Total Risk Contribution (per \$1000)	6	4	240

- $F = \{\text{internet, blue chip}\}$ : The set of investment funds.
- budget: The total funds available for investment (maximum of \$50,000).
- $\text{Max investment}_{\text{internet}}$ : The maximum amount that can be invested in the Internet Fund (at most \$35,000).
- $\text{total\_risk}$ : The maximum risk contribution allowed for both investments (maximum of 240,000).

- annual\_rate  $i$  : The projected annual return rates for each fund  $i$ , where  $i \in F$ . Here, 12% for the Internet fund and 9% for the Blue Chip fund.
- Risk  $i$ : The risk contributions per dollar invested in each fund  $i$ , where  $i \in F$ . Here, 6 per \$1,000 for the Internet fund and 4 per \$1,000 for the Blue Chip fund.

## Objective in Words

Decide the optimal investment amounts for the portfolio, consisting of a combination of the Internet Fund and the Blue Chip Fund, to maximize the total projected annual return. This decision must adhere to the following constraints:

1. The total investment must not exceed \$50,000.
2. The investment in the Internet Fund is capped at \$35,000.
3. The total risk rating for the portfolio must not exceed 240, in line with the client's moderate risk tolerance.
4. All investment amounts must be non-negative.

## Decision Variables

Let  $x_i$  = the types of funds that exist in a portfolio  $i$  for  $i \in F$ .

- $x_1$ : Amount invested in the Internet fund.
- $x_2$ : Amount invested in the Blue Chip fund.

## Algebraic Formulation

$$\sum_{i \in F} \text{annual\_rate}_i * x_i \quad (\text{maximize total return})$$

Subject to:

$$\sum_{i \in F} x_i \leq \text{total budget} \quad (\text{total budget constraints})$$

$$x_{\text{internetfunds}} \leq \text{max investment internet} \quad (\text{investment limit constraints})$$

$$\sum_{i \in F} x_i * \text{risk}_i \leq \text{total risk} \quad (\text{total risk constraints})$$

$$x_i \geq 0, i \in F \quad (\text{non negativity constraints})$$

## Implementation

Please refer to the attached drive link, which contains the Google Colab file, `python assignment 2 .ipynb`, for the implementation and solution of the model using Python and AMPL. Additionally, it includes an Excel file with the solution.

<https://drive.google.com/drive/folders/15sYUvEyeFnRgD6SbtiYyEbIRh3N5WEVF>

## Results

The optimal solution is to invest \$20,000 in the Internet fund and \$30,000 in the Blue Chip fund, resulting in a maximum total return of \$5,100 for the entire portfolio.

## AI Training

<https://chatgpt.com/share/66f59183-9d04-800e-9bd4-f59f63ca68ad>