

# Personal finance problem – linear programming



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PERSONAL FINANCIAL INVESTMENT STRATEGY ANALYSIS [pic] PROBLEM: Bob and Pina Ing, 31 and 28, a newly-wed couple found themselves in the midst of an interesting decision making problem. It appeared that their fortune had turned overnight when they won a mega lottery and received one million dollars after tax in price money. They were confused about how to invest their money, such that it gives them the maximum return on their investment. The couple consulted Jayhawks Financial Services LLC (JFS) to prepare a personal investment portfolio for them. ASSUMPTIONS and KEY FACTS:

Bob is a very enthusiastic person and he wants to make the maximum out of the investments. He is willing to put all of this money in equity market. However, he is aware that concentrating the investments in one particular stock increases the risk and he understands the importance of diversification. After talking to JFS consultants, he is convinced that it would be a good idea to diversify his securities and equities investments in three categories: lump-sum stocks, government bonds and high growth mutual funds. But, he is not sure of how much money he should invest in each category.

He gave the guidelines that at least 10% of the total money should be invested in each of those options and the investment in any of the above category should not exceed 40% of the total investment. He also mentioned that investment in mutual funds should be at least twice the amount invested in stocks. Pina, on the other hand is more interested in investing in precious metals like gold and silver. She has seen that the growth in these

commodities had shown remarkable returns over past few years, but she is not sure how risky that investment would be.

So, they decided that their investment in precious metals should not exceed 15% of their total investment. She also believed that she should not be very aggressive when it comes to investing and found her comfort zone in FDIC insured savings account which was considered as least risky investment by their consultants. JFS did their research and came up with the estimates of return on investments rate in each investment category. JFS also assigned the risk rating to each of the investment categories based on their research.

They assigned the risk rating ranging from 1 to 10, with 1 being the least risky investment and 10 being the most risky investment. Bob, considered himself as an aggressive investor and was willing to take an average risk of 7. However, Pina is more risk averse and individually she would have chosen average risk rating of less than 5. Finding the middle ground, they informed their consultant to suggest a portfolio such that their average risk does not exceed 5. REQUIREMENTS: Based on the above information and assumptions, LLC came up with the requirement draft for the couple.

The portfolio suggestion should comply with the given funding allocation requirements.

Investment	Estimated ROI (%)	Risk rating
Stocks	9.0	7
Mutual Funds	5.5	5
Government Bonds	4.1	3
Precious Metals	12.9	9
Savings Account	3.0	1

The goal is to allocate the money to the above mentioned categories to:

1. Maximize the return on investment of each dollar.
2. Have an average risk of no more than 5.
3. Invest at least 10% but no more than 40% of total investment in each of equities and

securities markets. 4. Invest no more than 15% of total investment in precious metals. 5. Investments in mutual funds should be at least twice the amount invested in stocks. METHODOLOGY:

JFS used the linear programming model approach to optimize the financial portfolio fund allocation based on the guidelines provided. The following LP mathematical model was developed by JFS:

\_\_\_\_\_ LET:  $m_1$   
 = amount of money [in dollars] that should be invested in stocks.  $m_2$  = amount of money [in dollars] that should be invested in mutual funds.  $m_3$  = amount of money [in dollars] that should be invested in government bonds.  $m_4$  = amount of money [in dollars] that should be invested in precious metals.  $m_5$  = amount of money [in dollars] that should be invested in savings account.

O. F:  $\text{MAX } [0.09]m_1 + [0.055]m_2 + [0.041]m_3 + [0.122]m_4 + [0.03]m_5$   
 [Return in dollars] S. T:  $m_1 + m_2 + m_3 + m_4 + m_5 = 1,000,000$  (total investment)  
 $7m_1 + 5m_2 + 3m_3 + 9m_4 + m_5 = 100,000$  (min investment in equities and securities)  
 $m_1, m_2, m_3 = 0$  (non-negativity)

\_\_\_\_\_ The  
 Financial Investment Portfolio analysis was optimized using Management Scientist software. The software analysis results are attached in the appendix. RESULTS: As can be seen from the results of the LP model, the maximum return on investment that Bob and Pina can get is 6. % after a year. This means if they invest one million dollar in the given portfolio with the given constraints, than they would earn \$65328. 71 on the investment. RECOMMENDATIONS: To get the above return and still be reasonably safe in  
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their investment, JFS recommends Bob and Pina to invest approximately 18% in stocks and 37% in mutual funds. They should only invest 10% of their money in less rewarding government bonds. They should take the full advantage of the highly rewarding investment in gold or silver by investing their limit of all 15% of total investment.

And finally they should offset the risk of investing in precious metal by investing 20% of their investment in highly secure savings account. The exact amount of suggested portfolio is as below: Stocks : \$185714. 29  
Mutual Funds:\$371428. 57 Government Bonds:\$100000. 00 Precious Metals:  
\$150000. 00 Savings account:\$192857. 14 The above portfolio seems to be well diversified portfolio, which will give them a decent return of 6. 53% on their investment and still be safe. APPENDIX: [pic] Fig 1: Management Scientist LP Modeling [pic] Fig 2: Management Scientist Solution