

UNIVERSITY OF MASSACHUSETTS

Isenberg School of Management

Department of Finance and Operations Management

FOMGT 353-Introduction to Management Science

Homework #5 – Using Excel.

Show your work completely and in an organized manner to receive maximum credit. Correct answers without supporting calculations or diagrams will not receive credit. Incorrect answers using the correct method and a good presentation will receive substantial credit.

My name is:

Risk Minimization

You are an investment advisor. Andrew is your client. He has a maximum of \$100,000 to invest. He has identified four different types of investment and will accept no others:

Investment	Rate of Return	The Risk Value you have allocated to the investment.
FarEast	16%	10
European	15%	8
USIndustrial	15%	6
USTreasuries	5%	2

Andrew also wants to invest at least \$10,000 in the FarEast, at least \$15,000 in Europe, at least \$20,000 in USIndustrials and at least \$ 30,000 in US Treasury Bills.

He wants to have an income of at least \$10,000, but is very risk averse so he would like this to come with the lowest possible risk.

1. Formulate the model.

Let the amount invested in the Far East Fund be the variable FarEast
 Let the amount invested in the European Fund be the variable European
 Let the amount invested in the US Industrial Fund be the variable Industrial
 Let the amount invested in the US Treasuries Fund be the variable USTreasuries

minimize $10 * \text{FarEast} + 8 * \text{European} + 6 * \text{USIndustrial} + 2 * \text{USTreasuries}$

Subject to

$0.16 * \text{FarEast} + 0.15 * \text{European} + 0.15 * \text{USIndustrial} + 0.05 * \text{USTreasuries} \Rightarrow 10,000$

$\text{FarEast} + \text{European} + \text{USIndustrial} + \text{USTreasuries} \leq 100,000$

$\text{FarEast} \Rightarrow 10,000$

$\text{European} \Rightarrow 15,000$

$\text{USIndustrial} \Rightarrow 20,000$

$\text{USTreasuries} \Rightarrow 30,000$

2. Express the model in Excel, and print out the worksheet and attach it to your Homework.

	A	B	C	D	E	F	G
1	Objective						
2			=((B7*E7)+(B8*E8)+(B9*E9)+(B10*E10))				
3	Objective	466,000.00					
4							
5	Decision Variables			Return	Risk Factor		
6							
7	FarEast	10,000.00		0.16	10		
8	European	15,000.00		0.15	8		
9	Industrial	31,000.00		0.15	6		
10	USTreasuries	30,000.00		0.05	2		
11		86,000.00					
12	Constraints						
13					Limit		
14	Return	10,000.00	=(B7*D7)+(B8*D8)+(B9*D9)+(B10*D10)		10,000		
15	Investment	86,000.00	=SUM(B7:B10)		100,000		
16	MinFarEast	10,000.00	=B7		10,000		
17	MinEuropean	15,000.00	=B8		15,000		
18	MinIndustrial	31,000.00	=B9		20,000		
19	MinUSTreasuries	30,000.00	=B10		30,000		
20							

3. Use the Solver to obtain a solution. Print out the Answer worksheet and the Sensitivity worksheet and attach them to your Homework.

Microsoft Excel 9.0 Answer Report
Worksheet: [RiskMin.xls]Homework
Report Created: 3/14/2002 7:46:18 PM

Target Cell (Min)

Cell	Name	Original Value	Final Value
\$B\$3	Objective	466,000.00	466,000.00

Adjustable Cells

Cell	Name	Original Value	Final Value
\$B\$7	FarEast	10,000.00	10,000.00
\$B\$8	European	15,000.00	15,000.00
\$B\$9	Industrial	31,000.00	31,000.00
\$B\$10	USTreasuries	30,000.00	30,000.00

Constraints

Cell	Name	Cell Value	Formula	Status	Slack
\$B\$14	Return	10,000.00	\$B\$14>=\$E\$14	Binding	-
\$B\$15	Investment	86,000.00	\$B\$15<=\$E\$15	Not Binding	14000
\$B\$16	MinFarEast	10,000.00	\$B\$16>=\$E\$16	Binding	-
\$B\$17	MinEuropean	15,000.00	\$B\$17>=\$E\$17	Binding	-
\$B\$18	MinIndustrial	31,000.00	\$B\$18>=\$E\$18	Not Binding	11,000.00
\$B\$19	MinUSTreasuries	30,000.00	\$B\$19>=\$E\$19	Binding	-

Microsoft Excel 9.0 Sensitivity Report
Worksheet: [RiskMin.xls]Homework
Report Created: 3/14/2002 7:46:18 PM

Adjustable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
\$B\$7	FarEast	10,000.00	-	10	1E+30	3.6
\$B\$8	European	15,000.00	-	8	1E+30	2
\$B\$9	Industrial	31,000.00	-	6	0	6
\$B\$10	USTreasuries	30,000.00	-	2	1E+30	0

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
\$B\$14	Return	10,000.00	40.00	10000	2100	1650
\$B\$15	Investment	86,000.00	-	100000	1E+30	14000
\$B\$16	MinFarEast	10,000.00	3.60	10000	10312.5	10000
\$B\$17	MinEuropean	15,000.00	2.00	15000	11000	15000
\$B\$18	MinIndustrial	31,000.00	-	20000	11000	1E+30
\$B\$19	MinUSTreasuries	30,000.00	-	30000	21000	30000

4. What Portfolio do you recommend to Andrew?

His Portfolio should comprise \$10,000 of the FarEast, \$15,000 of the European, \$30,000 in US Treasuries and \$31,000 in US Industrial. At a risk factor of 466,000. (If you assumed that the Risk factors were per thousand dollars, then the risk factor would be 466!)

5. Use the Sensitivity Report to work out how much extra risk Andrew would take on and by how much his income would be increased, if his income were increased as much as possible without changing the Basic Variables in the solution. (Or to put it another way, without causing another constraint to become binding!)

Extra Risk = Shadow Price * Allowable Increase
 $40.0 * 2,100 = 84,000$ risk points.

If you divided by 1,000 in the Objective function then:

Extra Risk = Shadow Price * Allowable Increase
 $0.04 * 2,100 = 84$ risk points

Extra Income = \$2,100.