MATH3202/7232 Operations Research & Mathematical Planning 2020

Tutorial 4 – Portfolio Optimisation

Part 1

A manager must decide how to invest $100,000 for one year in different financial products. Her goal is to maximise earnings while avoiding high-risk exposure.

The financial products available are given in the following table:

Financial Product	Market	Return (%)
1	Cars (Germany)	10.3
2	Cars (Japan)	10.1
3	Computers (USA)	11.8
4	Computers (Singapore)	11.4
5	Appliances (Europe)	12.7
6	Appliances (Asia)	12.2
7	Insurance (Germany)	9.5
8	Insurance (USA)	9.9
9	Short-term bonds	3.6
10	Medium-term bonds	4.2

The investment requirements are

1. No more than $30,000 in the car options
2. No more than $30,000 in the computer options
3. No more than $20,000 in the appliance options
4. At least $20,000 in the insurance options
5. At least $25,000 in the bonds
6. At least 40% of the amount invested in medium-term bonds must be invested in short-term bonds
7. No more than $50,000 in Germany options
8. No more than $40,000 in USA options

The manager would like to know

a) What investment portfolio will maximise earnings?

b) How much would the optimal earnings improve if we could put more than $20,000 in the appliance options?

c) How much higher would the return on Insurance (Germany) have to be before it became part of the optimal portfolio?

Part 2

The manager is now considering a two-year investment strategy, where $100,000 is invested each year. The returns for the first year are as in the table above. The returns for each product in the second year will depend upon the economic environment for the second year, which will not be known until the end of the first year. The possible scenarios are:

Scenario	Probability
Business as usual	0.80
Downturn	0.15
Upturn	0.04
Crash	0.01

The returns for each product in each scenario will be included in a Python stub.

The investments for the second year are made at the end of the first year. The investment requirements for the first year do not have to be followed in the second year but the amount invested in any product must be within $10,000 of the amount invested in that product in the first year.

What is the manager's optimal two-year investment strategy?