**Risk Homework (Chapter XIV)**

**Exercise #1**

1. Suppose you are consulting with an investor to determine how much of 4 stocks to buy. From previous years' experi­ence, the investor has observed the following data on returns per five hundred dollars invested from each of the four stocks:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Obs |  | Stock 1 |  | Stock 2 |  | Stock 3 |  | Stock 4 |
| 1 |  | 55.00 |  | 45.00 |  | 35.00 |  | 20.00 |
| 2 |  | 60.00 |  | 70.00 |  | 28.00 |  | 20.00 |
| 3 |  | 18.00 |  | 28.00 |  | 30.00 |  | 22.00 |
| 4 |  | -30.00 |  | 42.00 |  | 12.00 |  | 19.00 |
| 5 |  | 50.00 |  | 15.00 |  | 40.00 |  | 21.00 |
| 6 |  | 60.00 |  | 40.00 |  | 22.00 |  | 18.00 |
| 7 |  | 41.00 |  | 30.00 |  | 35.00 |  | 20.00 |
| 8 |  | 16.00 |  | 19.00 |  | 36.00 |  | 20.00 |

The investor has 500,000 to invest.

a. Formulate the investor's problem using the E‑V criterion.

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2. Model the following situation. A farm plan is to be established for a 400 acre farm in which the only binding constraints are land and tractor time. The variables involved are the acreage of crops 1 and 2 which are grown. The technical coefficients are uncertain and possess the following distribution.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Objective Function | | | | | | |  |  |  |  |  |  |
|  |  | Crop 1 | | |  | Crop 2 | | |  | Tractor Use Per Acre | | |  | Tractor Hours Available |
| Observation |  | Cost/Acre |  | Revenue/Acre |  | Cost/Acre |  | Revenue/Acre |  | Crop 1 |  | Crop 2 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 |  | 100 |  | 150 |  | 100 |  | 185 |  | 1.4 |  | 1.7 |  | 600 |
| 2 |  | 100 |  | 140 |  | 100 |  | 205 |  | 1.8 |  | 1.3 |  | 640 |
| 3 |  | 100 |  | 180 |  | 100 |  | 145 |  | 2.1 |  | 1.1 |  | 560 |
| 4 |  | 100 |  | 120 |  | 100 |  | 225 |  | 1.2 |  | 2.0 |  | 620 |
| 5 |  | 100 |  | 210 |  | 100 |  | 115 |  | 1.5 |  | 1.4 |  | 580 |
| Mean |  | 100 |  | 160 |  | 100 |  | 175 |  | 1.6 |  | 1.5 |  | 600 |

a. Set up a LP to determine how much of each crop to grow given this un­certainty.

b. Tell how you would find the risk aversion coefficients.

3. Suppose you are feeding animals and selling crops and you have the follow­ing model:



where x is the quantity of crops sold, y is the acres of crops grown

z is the number of animals fed, a is the quantity of crops produced by one acre, and b is the quantity of crops required to feed one animal.

Suppose that a and b are uncertain over time; i.e., suppose you have 5 proba­bilistic forecasts for a and b

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | Values of | | |
| Observation |  | Probability |  | a |  | b |
| 1 |  | .2 |  | 140 |  | 10 |
| 2 |  | .1 |  | 120 |  | 12 |
| 3 |  | .3 |  | 130 |  | 10 |
| 4 |  | .15 |  | 150 |  | 13 |
| 5 |  | .25 |  | 140 |  | 8 |

Develop models to incorporate this information under two assumptions:

a) You must buy the animals and plant the crops now.

b) You buy the animals after crop harvest and therefore can adjust their numbers dependent upon yield.

3. Set up a GAMS formulation with portfolio risk in your earlier model