

Assignment #6

This assignment is due in class next Thursday, March 25, 1999. For this assignment, it will be best if you work together in groups of 2 or 3. You have the option of doing this assignment alone, but I think it's best if you do it as a group. Each group with more than one person gets THREE dice. If you are doing it alone, you get one and will have to pretend.

For this homework exercise, you will use three dice to simulate the uncertainty in financial markets. There are three basic instruments in this simplified market, each associated with a single die.

Color Die	Annual Return	Variability (SD)
Green	7.5%	20%
Red	71%	130%
White	0%	5%

- (1) Before starting the simulation, which of the three investments looks most appealing to you? Does the group agree (have a consensus) or is it not so clear? Explain your choice briefly.
- (2) The rest of this assignment deals with a small simulation of these three financial instruments represented by the dice described above. For each "year" of the game, you will roll all three dice, and use the outcomes to determine what has happened to the value of each investment. Each of the three investments starts off with an initial value of \$1000. You need to run the game out for at least 25 years. Which investment wins? Is it the same one that you picked in Question 1? Try to explain any differences or surprises.

The following table shows how the rolls of the dice affect the values of the three investments.

Roll	Green	Red	White
1	0.8	0.06	0.9
2	0.9	0.2	1
3	1.05	1	1
4	1.1	3	1
5	1.2	3	1
6	1.4	3	1.1

For example, suppose that on the first roll of all three dice, you obtain

(Green 2) (Red 5) (White 3)

Then the values of the investments after the first year become

Green: $\$1000 \times 0.9 = \900

$$\begin{aligned}\text{Red:} & \quad \$1000 \times 3 = \$3000 \\ \text{White:} & \quad \$1000 \times 1 = \$1000\end{aligned}$$

For the next roll, the values are compounded from these. Suppose that on the second roll of all three dice, you obtain

$$(\text{Green } 4) \quad (\text{Red } 2) \quad (\text{White } 6)$$

then the values of the three investments after two years are

$$\begin{aligned}\text{Green:} & \quad \$900 \times 1.1 = \$990 \\ \text{Red:} & \quad \$3000 \times 0.2 = \$600 \\ \text{White:} & \quad \$1000 \times 1.1 = \$1100\end{aligned}$$

(3) The final part of this assignment considers the performance of a hybrid investment, one which mixes the outcomes of “Red” and “White”. To compute the value of this investment, roll both the red and white dice for each round. It’s easiest to describe what to do with an example. Before doing any simulating, what do you think of this hybrid.

(4) Again, simulate the hybrid. What happens? How does it compare to the previous instruments?

For the first round, using the same dice rolls as above (Green 2), (Red 5) and (White 3), the value of this “Pink” investment is

$$\text{Pink:} \quad \$1,000 \times \frac{3 + 1}{2} = \$2,000$$

and compounded in the second round which had (Green 4), (Red 2), and (White 6)

$$\text{Pink:} \quad \$2,000 \times \frac{0.2 + 1.1}{2} = \$1,300$$