**Risk modeling – Practice Problems**

1. *Investments.* One of Philip Mahn’s investments is going to mature, and he wants to determine how to invest the proceeds of $30,000. Philip is considering two new investments: a stock mutual fund and a one-year certificate of deposit (CD). The CD is guaranteed to pay an 8% return. Philip estimates the return on the stock mutual fund as 16%, 9%, or -2%, depending on whether market conditions are good, average, or poor, respectively. Philip estimates the probability of a good, average, and poor market to be 0.1, 0.85, and 0.05, respectively.
   1. What are the decision alternatives?
   2. What are the states of nature and their probabilities?
   3. Draw a decision tree for this problem.
   4. Calculate the EV for each decision alternative.
   5. Which decision alternative should be chosen according to the Expected Value criterion?
2. *Construction.* Pittsburgh Development Corporation (PDC) purchased land that will be the site of a new luxury condominium complex. The location provides a spectacular view of downtown Pittsburgh and the Golden Triangle, where the Allegheny and Monongahela Rivers meet to form the Ohio River. PDC plans to price the individual condominium units between $300,000 and $1,400,000.

PDC commissioned preliminary architectural drawings for three different projects: one with ***30 condominiums***, one with ***60 condominiums***, and one with ***90 condominiums***. The financial success of the project depends on the size of the condominium complex and the chance event concerning the demand for the condominiums. PDC president considers two possible chance event outcomes: a ***strong demand*** and a ***weak demand***. The probability of a strong demand is ***0.8***, and the probability of a weak demand is ***0.2***. Given the following payoff table, answer parts a through d. Note that the payoffs in Table 1 are given in million dollars.

|  |  |  |
| --- | --- | --- |
|  | Strong Demand | Weak Demand |
| Small Complex | 8 | 7 |
| Medium Complex | 14 | 5 |
| Large Complex | 20 | -9 |

Table 1. Payoff table for question 1

* 1. What are the decision alternatives?
  2. What are the states of nature and their probabilities?
  3. Draw a decision tree.
  4. Calculate the expected value (EV) for each decision alternative.
  5. Which decision alternative should be chosen according to the EV rule?

1. *Car dealership.* A car dealer is offering the following three two-year leasing options:

|  |  |  |
| --- | --- | --- |
| Plan | Fixed Monthly Payment | Additional Cost Per Mile |
| I | $200 | $0.095 per mile |
| II | $300 | $0.061 for the first 6,000 miles;  $0.050 thereafter |
| III | $170 | $0.000 for the first 6,000 miles;  $0.14 per mile thereafter |

Assume that a customer expects to drive between 15,000 to 35,000 miles during the

next two years according to the following probability distribution:

P(driving 15,000 miles) =0.1

P(driving 20,000 miles) = 0.2

P(driving 25,000 miles) = 0.2

P(driving 30,000 miles) = 0.3

P(driving 35,000 miles) = 0.2

* 1. Draw a decision tree for this problem.
  2. Which decision alternative should be chosen according to the EV rule?

1. *Fashion Retailer.* Consider a fashion retailer who, in advance of the selling season purchases sweaters at 4 dollars per unit to sell at 10 dollars per unit. The retailer knows that if the product is “cold” demand may be represented as a discrete random variable distributed uniformly between 0 and 10 (each value between 0 and 10 is equally likely, including 0 and 10). And, the retailer knows that if the product is “hot” demand may be represented as a discrete random variable distributed uniformly between 20 and 30 (each value between 20 and 30 is equally likely, including 20 and 30). The objective is to maximize expected profit by choosing the number of sweaters to order.
   1. If it is known that the demand is cold, to achieve the optimum solution, how many sweaters will be ordered?
   2. If it is known that the demand is hot, to achieve the optimum solution, how many sweaters will be ordered?
   3. If the probability that the market is cold is .5 and the probability that the market is hot is also .5, to achieve the optimum solution, how many sweaters will be ordered?