1. For the last 29 years the operator of a toll bridge has kept records of the use of the bridge during each month of the year. For the upcoming month of May, he would like to predict the expected income from operation of the bridge. From the data given below and the toll charge of $0.50 per vehicle, what is the expected income for the bridge during the month of May.

|  |  |  |  |
| --- | --- | --- | --- |
| Year | Number of Cars | Year | Number of Cars |
| 1959 | 10,234 | 1974 | 10,187 |
| 1960 | 12,900 | 1975 | 10,648 |
| 1961 | 11,879 | 1976 | 11,645 |
| 1962 | 9,075 | 1977 | 10,975 |
| 1963 | 10,396 | 1978 | 12,375 |
| 1964 | 10,746 | 1979 | 10,357 |
| 1965 | 13,056 | 1980 | 13,078 |
| 1966 | 12,874 | 1981 | 10,284 |
| 1967 | 11,789 | 1982 | 9,993 |
| 1968 | 10,678 | 1983 | 11,964 |
| 1969 | 10,357 | 1984 | 9,876 |
| 1970 | 9,234 | 1985 | 12,675 |
| 1971 | 10,345 | 1986 | 10,467 |
| 1972 | 11,465 | 1987 | 13,127 |
| 1973 | 12,385 |  |  |

1. A consulting firm has to make a decision concerning bidding on a major project that

has a projected profit for the firm of $100,000. Engineers for the firm estimate that they have about a 20% chance of receiving the contract if all the work on the proposed bid is done in-house. An outside consultant could be hired to help prepare the bid, which would increase the probability of success in being awarded the contract to about 50%. The outside consultant would cost $20,000. Using a decision tree, determine what action the firm should take.

1. An engineer must decide between spread footings or piles for a foundation to support each column of a building. The soil strength is not known for certain, but could be low (1), medium (2), or high (3). Spread footings for the building have a total cost of $150,000, while piles cost $250,000. The piles are considered “safe” in that if the actual soil strength turns out to be low, no damage will result to the building. The spread footings are less expensive but would result in some building damage if the soil strength is low or medium, and they would have to be replaced with piles (under difficult construction conditions) if the soil strength is low. Costs are summarized in Table 1. For $10,000, field studies and a triaxial strength test can be conducted. Based on 100 samples, the actual strength of the soil samples are as follows: 30 of the samples had a low strength, 40 had a medium strength, and 30 had a high strength. The experimental results from the triaxial strength test are summarized in Table 2. Using a decision tree, determine what the engineer should do.

Table 1: Cost Data

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Spread Footings | | | | Piles | | |
| Soil Strength | Foundation Cost | Damage Cost | Replacement Cost | Foundation Cost | Damage Cost | Replacement Cost |
| 1 (Low) | $150,000 | $100,000 | $1,000,000 | $250,000 | ----------- | ----------- |
| 2(Medium) | $150,000 | $50,000 | ------------ | $250,000 | ----------- | ----------- |
| 3 (High) | $150,000 | ----------- | -------------- | $250,000 | ----------- | ----------- |

Table 2: Results from Triaxial Strength Tests

|  |  |  |  |
| --- | --- | --- | --- |
|  | No. of samples that Triaxial Strength Test Indicated Particular Strength | | |
| Soil Strength | z1, Low | z2, Medium | z3, High |
| 1 (Low) | 24 | 5 | 1 |
| 2(Medium) | 15 | 20 | 5 |
| 3 (High) | 5 | 15 | 10 |