15-10. (This is adapted from an example in a paper by C. H. Oglesby and E. L. Grant published in Volume 37 of *Highway Research Board Proceedings*.)

It is desired to select a size for a box culvert for a rural highway in central Illinois. The drainage area has 400 acres of mixed cover with slopes greater than 2%. The culvert will be 200 ft long. Because headroom is critical, the culvert can be only 4 ft high. If the water rises more than 5 ft above the streambed, the road will be overtopped. Damage to highway and adjacent property for each overtopping will be $150,000.

If the project is to be built at all, the minimum acceptable culvert for this location is a simple box 10 × 4 ft, which will be overtopped, on the average, once in 5 years. Four possible designs, with associated initial costs, capacities, and probabilities of overtopping, are:

Combination	3,600,000
Oil	4,500,000

Draw a decision tree to describe the alternatives and probable events case. If the company makes its decision based on maximum expected value alternative will be chosen? Discuss the various ramifications of the outcome and probabilities associated with this decision.

15–13. Set up a decision matrix as described in the text for Problem 15–1 the maximum security level strategy. What are the implications of a strategy type applied to decisions of the type faced by a small independent oil company such as Ewing Oil? Discuss this question in relationship to frequency probabilities, as used in Problem 15–12, and intuitive probabil