Practice Exercises
The Value of Information and Options

1. Credit Granting Policy

A lending company was reviewing its credit policy for small personal loans. These consumer loans average about $1000 and the company earns $1200 with interest and fees if the loan is paid back, that is, a profit of $200 per fully repaid loan. The company management felt that it was important to optimize their decisions for these loans, because they represented a potentially large volume of business.

They wanted to focus on what to do about loan applications classified as "Marginal". The credit manager explained the current policy as follows. Anytime we get a request for credit, we first check the customer's credit rating. Our current policy is to reject the requests classified as Marginal. However, we may want to begin extending credit to them. There are two ways we can do this: (a) extend credit to all "Marginal" applicants, or (b) obtain an in-depth credit report (costing about $20) for each "Marginal" applicant, and then make the decision based on this supplementary information. The credit report would allow classification of Marginal customers into four subgroups: A, B, C, and D. Based on data from other divisions of the company, the credit manager estimated that 25% of applications would fall in the A group, 30% in B, 25% in C and 20% in D. The data compiled also indicated the default rate for each subgroup: for subgroup A, the probability of default was 0.1; for B it was 0.2; for C, 0.3; and for D, 0.5.

On credit accounts in default for this type of loans, the company recovers on average about 40% of the amount lent, that is, $400.

a) Set up a decision tree model to evaluate the optimal credit policy.

b) What is the value of the information provided by the special credit report?

c) How would you price the credit risk presented by the clients whose credit applications are turned down? (Hint: consider how much of a premium should be charged to make it worthwhile, at the limit, to extend credit to these applicants.)

2. Value of a forecast

Revisit the exercise "Selling Shares and Option Value" from the previous Exercise Set. Suppose Omar could buy a forecast from a robo-advisor. Using AI algorithms and data mining, the robo-advisor can generate a forecast whether the stock price will be up or down in the next two weeks (not by how much it will change). However, the AI system's predictions are not 100% reliable, as evidenced by matching its forecasts with actual outcomes, across all the cases on which the system made predictions. For stocks that went up in price, the AI system had predicted "Up" in 90% of cases and made incorrect forecasts of "Down" for 10% of those. Looking at the stocks that went down, the system had correctly predicted "Down" for 80% of those (and incorrectly "Up" for 20%).

a) Construct a decision branch, or add to the decision tree previously constructed, to represent the alternative of obtaining the robo-advisor's forecast and then decide whether to sell or hold the

shares based on the forecast. Calculate the appropriate probabilities of all the event branches involved.

b) What is the most Omar should be willing to pay for the robo-advisor's service?

c) How does the answer in (b) change if the robo-advisor's forecasts were perfect, that is, if it made 100% of correct predictions? Compare this to the Option Value calculated in the previous exercise.

3. Marketing a Movie Release

The management of a motion picture studio is facing the decision of how to release a new film. Distributing as 'A' Feature means a more aggressive advertising and scheduling more screens at premium movie theaters in the opening week. Distributing as 'B' Feature is a less aggressive strategy, but also less risky in case the movie is a flop. The following payoff table for marketing choices has been determined (amounts in millions of dollars):

Box Office Result	Distribute as 'A' Feature	Distribute as 'B' Feature	Sell to TV network
Hit	25	15	5
Flop	-10	-5	5

The probability that this new production will be a hit has been judged initially at 30%. The studio is considering a pre-release forecast (e.g., based on sneak previews, or opinion markets, such as Hollywood Stock Exchange, www.hsx.com) before deciding how to market the new film. Historical data on films subjected to such market studies shows that 70% of successful films had received favorable forecasts, while 80% of the box office failures had obtained unfavorable forecasts.

a) Build a decision tree model to analyze this problem.

b) What probabilities should be assigned to box office hit if the forecast is favorable? If the forecast is unfavorable?

c) If the cost of obtaining a forecast is $500,000, would you recommend it be taken? (Assume that decisions are made based on expected monetary value.)