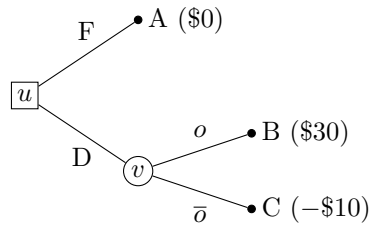


GSOE9210 Decision Methods for Engineers

Problem Set 01

1. For the decision tree of the Oil drilling example below:



- (a) What type of node is u ? v ? B?
- (b) The root node is of what type?
- (c) Suppose that the dollar values given doesn't include the additional cost of extracting oil. If the extraction cost is \$5, how should the tree be modified?

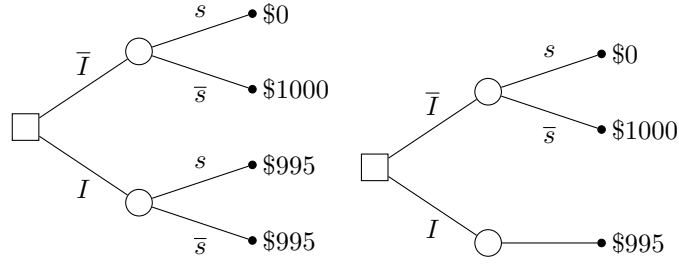
Solution

- (a) u is a decision node; v is a chance node.
 - (b) The root node (u) is a decision node.
 - (c) The outcome B (drill and find oil) would be reduced by \$5 to \$25.
2. Draw decision trees and decision tables for the problems below, as discussed in lectures:
 - (a) The necklace insurance problem.
Assume that the value of the necklace is \$1000 and the annual cost of insurance is \$5, and that insurance will reimburse the buyer for the full value of the necklace.
 - (b) The football club inventory problem.

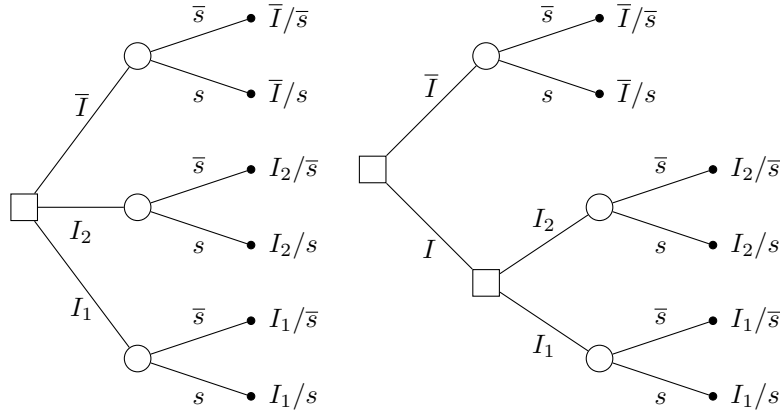
How would you modify the representations above if Alice had two insurance policies to choose from?

Solution

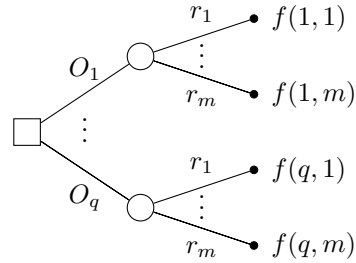
For the basic insurance problem:



Possible trees for the two insurance policy problem are shown below:



A possible decision tree for the football club problem is shown below:



where

$$f(q, m) = \begin{cases} 40m - (500 + 20q) & \text{if } q \geq m \\ 40m - (800 + 20q) & \text{if } q < m \end{cases}$$

3. Sam's dining problem

Sam is at a restaurant faced with the following meal choices: order either pasta or a salad as the main course, followed by either desert or coffee. The menu prices are:

Mains	Price	Deserts	Price
pasta	\$14	desert	\$8
salad	\$10	coffee	\$3

For this decision problem identify:

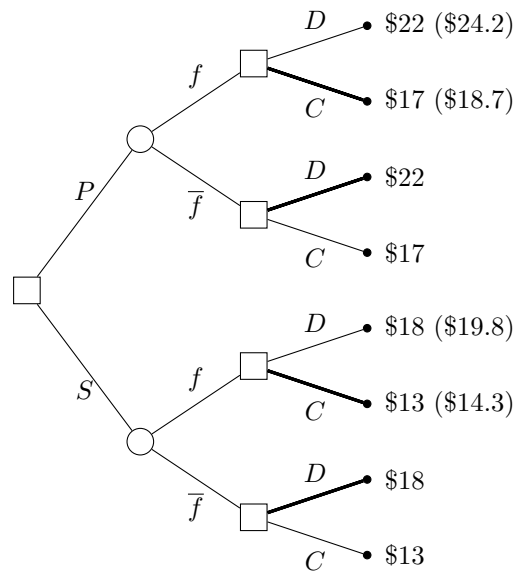
- (a) the actions
- (b) the possible states

Draw a decision tree in which the outcomes are measured by the total cost of the meal.

Solution

- (a) Primitive actions: order Pasta (P); order Salad (S); order Desert (D); order Coffee (C).
- (b) Possible states: full after main course (f); not full ($\bar{f}$).

The tree might look as follows:



- 4. Modify the decision tree for the dining problem above for the case where Sam gives a 10% tip if the main course is filling.

Solution

See the parenthesised values in the earlier tree.

- 5. Suppose that finishing with desert always leaves Sam feeling full. If Sam wants to ensure that he finishes his meal feeling full but wants to minimise the cost of the meal, what should be Sam's 'policy'?

Solution

Sam's policy to guarantee finishing full for the lowest price:

choose salad; if the salad is filling then choose coffee; if the salad is not filling then choose desert.

- 6.* Can you draw a decision table for Sam's dining problem above?

Hint: A decision table must represent a function mapping each action-state pair to a *unique* outcome.