Model-based Decision Analysis VU –2018

Note: If gold (Au) is found then the parcel of land can be sold for **£320m,** and if silver (Ag) is found the parcel of land can be sold for **£160m**.

Decision Tree: squares are decision nodes, circles are event nodes. The most left node is the root of the tree, you can find payoffs (blue colored numbers) at the leaves of the tree (leaves count as nodes). The red colored numbers are calculated during the backward recursion (starting at the leaves, working back to the root); at event nodes expected values are computed, at decision nodes the best alternative (red arrow) is chosen.

Calculating Payoffs: For each leaf you follow the path from the root to this leaf and aggregate profits and costs along this path to get the payoff.
- Upper most payoff (**0M**): you do nothing, therefore no costs and no profits
- Upper most but one (**154M**): you purchase the parcel of land and survey: 6M costs; you find silver and sell the parcel of land: 160M; therefore the payoff is $160 – 6 = 154$.
- Upper most but two: (**-6M**): you purchase the parcel of land and survey but you find neither silver nor gold; therefore the payoff is 0-6=-6M;
- At the alternative "Test Drilling" you have to calculate additional costs (250K+250K = 0.5M).

Backward Recursion: You start at terminal nodes (let call them leaves) and work recursively backwards till the root of the tree remains only. At a recursion step, you take any last but one node of the tree (i.e., if you go in the direction of the leaves there are only terminal nodes adjacent), and make this chosen node to a new terminal node (leaf) of the tree by cutting all branches towards current terminal nodes (leaves). The payoff of this newly created leaf is the (expected) payoff of the best alternative (at decision nodes) or the expected payoff (computed at event nodes).
- Consider the lower most event node (-6.12M): there are three leaves (153.5M, probability 0.002; -6.5M, prob. 0.9978; 313.5M prob. 0.0002). Hence the payoff for this new terminal node (leaf) is 153.5M x 0.002 – 6.5M x 0.9978 + 313.5M x 0.0002 = -6.12M.
- Going back a node you'll find a decision node with two alternatives (-0.5M and -6.12M); of course in this decision node you will decide not to purchase resulting in a payoff -0.5M.
- Going back a node you'll find an event node that is not valid for the next step of the backward recursion because the adjacent node at the upper branch is not a leaf (terminal node).
- However, you can continue at the event node labelled with red 1.5M (not at the decision node labelled 1.5M). There you have 153.5M*0.01-6.5M*0.97+313.5M*0.02 = 1.5M
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