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Introduction

In many problems chance (or probability) plays an important role. Decision analysis is the general name that is given to techniques for analyzing problems containing risk/uncertainty/probabilities. Decision trees are one specific decision analysis. For the following two examples draw the decision tree and solve them.

Example 1

The Metal Discovery Group (MDG) is a company set up to conduct geological explorations of parcels of land in order to ascertain whether significant metal deposits (worthy of further commercial exploitation) are present or not. Current MDG has an option to purchase outright a parcel of land for £4m.

If MDG purchases this parcel of land then it will conduct a geological exploration of the land. Past experience indicates that for the type of parcel of land under consideration geological explorations cost approximately £2m and yield significant metal deposits as follows:

- gold 0.04% chance
- silver 0.3% chance

Only one of these two metals is ever found (if at all), i.e. there is no chance of finding two or more of these metals and no chance of finding any other metal.

If gold is found then the parcel of land can be sold for £320m and if silver is found the parcel of land can be sold for £160m.

MDG can, if they wish, pay £750k for the right to conduct a three-day test exploration before deciding whether to purchase the parcel of land or not. Such three-day test explorations can only give a preliminary indication of whether significant metal deposits are present or not and past experience indicates that three-day test explorations cost £250k and indicate that significant metal deposits are present 50% of the time.

If the three-day test exploration indicates significant metal deposits then the chances of finding gold and silver increase to 2% and 1% respectively. If the three-day test exploration fails to indicate significant metal deposits then the chances of finding gold and silver decrease to 0.02% and 0.2% respectively.

Example 2

A company is trying to decide whether to bid for a certain contract or not. They estimate that merely preparing the bid will cost £10,000. If their company bid then they estimate that there is a 50% chance that their bid will be put on the "short-list", otherwise their bid will be rejected. Once "short-listed" the company will have to supply further detailed information (entailing costs estimated at £5,000). After this stage their bid will either be accepted or rejected.

The company estimate that the labor and material costs associated with the contract are £127,000. They are considering three possible bid prices (exclusive), namely £155,000, £170,000 and £190,000. They estimate that the probability of these bids being accepted (once they have been short-listed) is 0.90, 0.75 and 0.35 respectively.