Errata of
Partially Ordered Preferences in Decision Trees: Computing Strategies with Imprecision in Probabilities

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Abstract

The example in Page 5 of the original paper is a variant on the classic oil wildcatter problem, but the probability values presented there are incorrect. Here we rebuild the example with new probability values, and we correct the names of chance node in Figure 2.

The oil wildcatter example

An oil wildcatter must decide either to drill or not to drill. The cost of drilling is \$70,000. If the decision is to drill, the hole may be dry, wet or soak with a return of \$0, \$120,000 and \$270,000, respectively. The prior probabilities for the amount of oil ($P(O)$) are given as interval-valued probabilities: $P(O = dry)$ = [0.45, 0.50]; $P(O = wet)$ = [0.35, 0.40] and $P(O = soak)$ = [0.20, 0.20]. At the cost of \$10,000, the oil wildcatter can opt to take seismic soundings of the geological structure at the site. The soundings will disclose whether the terrain has no structure (almost no hope for oil), open structure (indication for some oil) or a closed structure (indication for much oil).

Table 1 shows the probabilities for oil given the seismic test results. The prior probabilities of test on no structure (ns), open structure (os) and closed structure (cs) are respectively: $[0.395, 0.450]$, $[0.325, 0.365]$ and $[0.215, 0.250]$.

Table 1: Conditional probabilities for oil given the test results.

$P(O\|T)$	ns	os	cs
dry	$[0.600, 0.823]$	$[0.308, 0.462]$	$[0.180, 0.233]$
wet	$[0.200, 0.310]$	$[0.329, 0.431]$	$[0.300, 0.488]$
soak	$[0.044, 0.051]$	$[0.219, 0.277]$	$[0.360, 0.465]$

Figure 2 shows the decision tree for this problem.

We solve this problem using a criterion that produces a single strategy (Γ-maximin) and a criterion that produces several strategies (E-Admissibility). Using Γ-maximin we start by finding the lower expectations for the decisions drill (d) and not drill $(\bar{d})$ at D_2, D_3, D_4, D_5. The admissible decisions are: $D_2 = (d)$, $D_3 = (\bar{d})$, $D_4 = (d)$ and $D_5 = (d)$. At decision node D_1 we have just two strategies (two multilinear programs to solve): $s_1 = \{\bar{s}, d\}$ (no sounding and drill) and $s_2 = \{s, (\bar{d}, d, d)\}$ (sounding and not drill only if no structure). Choosing s_1 we obtain the expectation $[20, 000, 26, 000]$ and, choosing s_2 the expectation is $[15, 951.08, 33, 907.87]$. Thus, according to Γ-maximin, the best option is take the strategy s_1. According to E-admissibility, the admissible decisions at D_2, D_3, D_4, D_5 are the same as Γ-maximin, but at D_1 both strategies $s_1 = \{\bar{s}, d\}$ and $s_2 = \{s, (d, \bar{d}, d, d)\}$ are admissible.

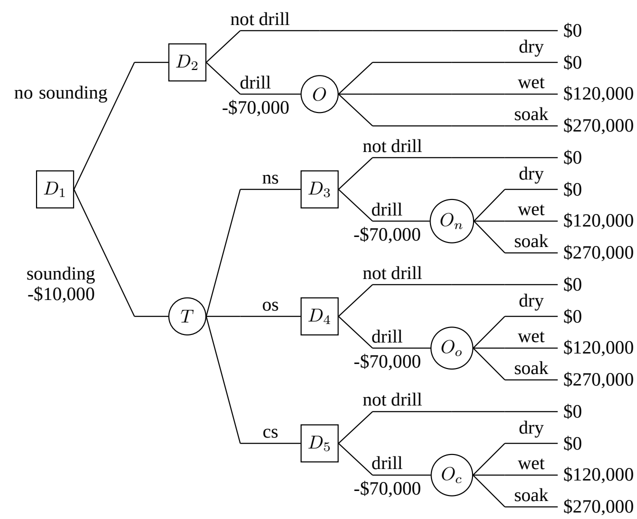

Figure 2: Decision tree for the oil wildcatter problem.

Acknowledgments

We thank Matthias Troffaes and Nathan Huntley for the comments and review.