Value of information

Definition: The difference in the expected value of a decision problem in which decisions were made with full knowledge*) of the outcomes of chance events and one in which no additional knowledge is available is called Expected value of perfect information (EVPI).

*) Interpretation: upper bound (not realistically achievable)

Definition: As above but replacing "full knowledge of the outcomes" by "imperfect information" is called Expected value of Imperfect information (EVII).

Calculate these for the oil drilling example. Consider all cases. Determine rewards.

	$A \cap B$	$A \cap B^c$	$A^c \cap B$	$A^c \cap B^c$
Drill in A	46	46	−31	−31
" " B	164	−31	164	−30
Do nothing	0	0	0	0
P	0.08	0.32	0.12	0.48

$(P(A \cap B) = P(A) \cdot P(B) = 0.4 \cdot 0.2 = 0.08$ etc.)

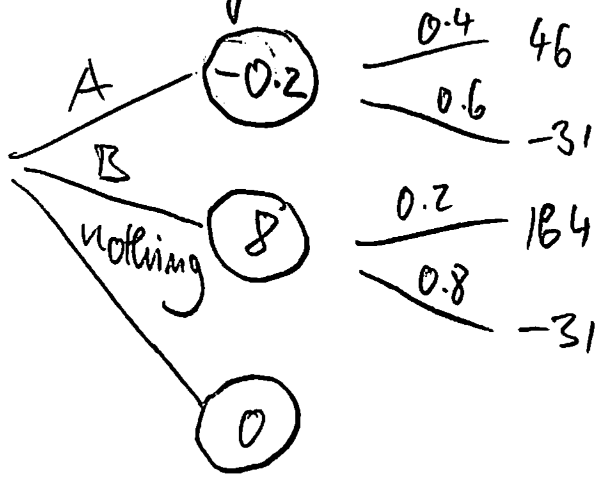
$$EMV = \sum P(\text{case})\, R(d \mid \text{case})$$

$$= 0.08 \cdot 164 + 0.32 \cdot 46 + 0.12 \cdot 164 + 0.48 \cdot 0 = \underline{\underline{47.52}}$$

$$EVPI = 47.52 - 8 = \underline{\underline{39.52}}$$

W3-L3

Note: 8 is the reward based on the decision problem between A, B, doing nothing, without any further information (see noon lecture)



For value of imperfect information consider two cases, test drilling in A and test drilling in B.

Test drilling in A:

$EVII = 9.5 - 8 = 1.5$ (including cost for test)

Test drilling in B:

$EVII = 15.3 - 8 = 7.3$ (includin cost for test)

Without cost for the test (see also in printed notes)

Test in A:

$EVII = 7.5$

Test in B:

$EVII = 13.3$

Need to be tranparent about including/excluding test drilling costs.

Medical treatment decision

Example Eye disease

X is disease status with

x_0 = does not have and will not develop disease

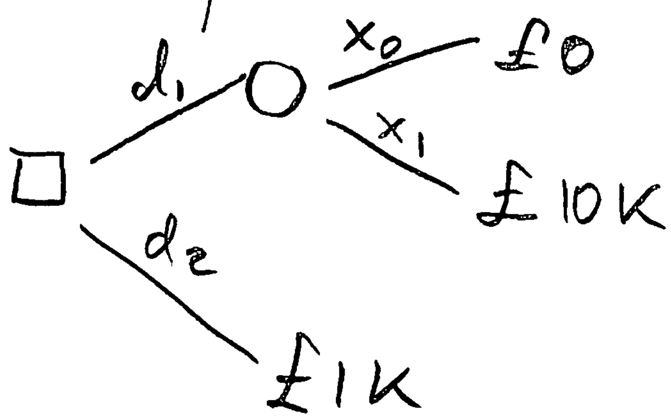
x_1 = has disease or will develop it later

Physician can not easily diagnose the disease.

Two options:

d_1 = wait & watch, (for visible symptoms) if patient develops disease (delayed) treatment costs £10K

d_2 = preventative treatment for all at £1K



$L(d_1, x_0) = £0$

$L(d_1, x_1) = £10K$

$L(d_2, \cdot) = £1K$

What is better?

Depends on prevalence in the population

$$p = P(X = x_1)$$

$$\bar{L}(d_1) = (1-p) \cdot £0 + p \cdot £10K$$

$$\bar{L}(d_2) = £1K$$

d_1 is preferred if $p \cdot £10K < £1K$

$$\Leftrightarrow p < 1/10$$