# 24.118: Paradox and Infinity

Ryan Lacey <rlacey@mit.edu>
Collaborator(s): Jorge Perez, Evan Thomas, Alvin Jeon

February 19, 2014

1. The expected value of partying is greater than the expected value of studying, therefore you should choose to party!

$$\begin{aligned} E(party) &= V(party, hard)P(hard|party) + V(party, easy)P(easy|party) \\ &= (-25)(0.2) + (35)(0.8) \\ &= 23 \end{aligned}$$

$$\begin{aligned} E(study) &= V(study, hard)P(hard|study) + V(study, easy)P(study, easy) \\ &= (18)(0.2) + (18)(0.8) \\ &= 18 \end{aligned}$$

2. The expected value of studying is greater than the expected value of partying, therefore you should choose to study...

$$\begin{aligned} E(party) &= V(party, hard)P(hard|party) + V(party, easy)P(easy|party) \\ &= (-25)(0.7) + (35)(0.3) \\ &= -7 \end{aligned}$$

$$\begin{aligned} E(study) &= V(study, hard)P(hard|study) + V(study, easy)P(study, easy) \\ &= (18)(0.2) + (18)(0.8) \\ &= 18 \end{aligned}$$

3. You can party or study with equal consequence if the professor gives exams such that:

   $P(hard|party) = \frac{17}{60}$ and $P(hard|study) = \frac{1}{5}$

   We know from `(2)` that expected value of partying when $P(hard|study) = \frac{1}{5}$ is 18. So solving for the conditional exam probability for the same expected value gives us what we want.

$$
\begin{aligned}
18 &= (-25)(P) + (25)(1-P) \\
-17 &= -60P \\
P &= \frac{17}{60}
\end{aligned}
$$

4. According to Evidential Decision Theory you should TwoBox. As long as the probablility of Closed having \$1M is nonzero, then the expected value of TwoBox must be greater than OneBox because the \$100 is guaranteed for both situations. Slightly more formally:

   $E(OneBox) = P(open = \$100)V(open) = (1)(100) = 100$

   $E(TwoBox) = P(open = \$100)V(open) + P(closed = \$0)V(closed) + P(closed = \$1M)V(closed) = 100 + \alpha\$1M$ for some $\alpha > 0$

5. Even under the predictor condition Evidential Decision Theory supports the OneBox strategy. In fact the OneBox strategy will be favored until the predictor's correctness approaches 50 %, in which case the expected value of TwoBox will bceome greater.

$$
\begin{aligned}
E(OneBox) &= V(full)P(full|OneBox) + V(empty)P(empty|OneBox) \\
&= (1000000)(0.8) + (0)(0.2) \\
&= 800,000
\end{aligned}
$$

$$
\begin{aligned}
E(TwoBox) &= V(full)P(full|TwoBox) + V(empty)P(empty|TwoBox) \\
&= (1000010)(0.2) + (10)(0.8) \\
&= 200,010
\end{aligned}
$$