Chapter 2

Axiom 2.5 (Transitivity of weak preference) If \( x \succeq y \) and \( y \succeq z \), then \( x \succeq z \) (for all \( x, y, z \)).

Axiom 2.6 (Completeness of weak preference) Either \( x \succeq y \) or \( y \succeq x \) (or both) (for all \( x, y \)).

Definition 2.11 (Indifference) \( x \sim y \) if and only if \( x \succeq y \) and \( y \succeq x \).

Definition 2.16 (Strict preference) \( x \succ y \) if and only if \( x \succeq y \) and it is not the case that \( y \succeq x \).

Definition 2.32 (Utility function) A function \( u(\cdot) \) from the set of alternatives into the set of real numbers is a utility function representing preference relation \( \succeq \) just in case \( x \succeq y \iff u(x) \geq u(y) \) (for all \( x, y \)).

How to do proofs

**Hint one:** To establish a proposition of the form \( x \rightarrow y \), assume what is to the left of the arrow \( (x) \) and derive what is to the right \( (y) \). If you want to establish a proposition of the form \( x \leftrightarrow y \), do it both ways.

**Hint two:** If you want to establish a proposition of the form \( \neg p \), assume the opposite of what you want to prove \( (p) \) and derive a contradiction.

Chapter 3

Definition 3.2 (Opportunity cost) \( c(a_i) = \max \{ u(a_1), u(a_2), \ldots, u(a_{i-1}), u(a_{i+1}), \ldots, u(a_n) \} \).

Proposition 3.25 (Expansion condition) If \( x \) is chosen from the menu \( \{x, y\} \), assuming that you are not indifferent between \( x \) and \( y \), you must not choose \( y \) from the menu \( \{x, y, z\} \).

Chapter 4

Axiom 4.6 (Range of probabilities) \( 0 \leq \Pr(A) \leq 1 \).

Axiom 4.7 (The equiprobability rule) If the outcome space \( \{A_1, A_2, \ldots, A_n\} \) consists of \( n \) equally probable individual outcomes, then \( \Pr(A_i) = 1/n \) (for all \( i \)).

Axiom 4.15 (The or rule) If \( A \) and \( B \) are mutually exclusive, then \( \Pr(A \lor B) = \Pr(A) + \Pr(B) \).

Axiom 4.18 (The everything rule) The probability of the entire outcome space is equal to one.

Axiom 4.19 (The not rule) \( \Pr(\neg A) = 1 - \Pr(A) \).

*Dept. of Philosophy, Stockholm University. Email: erik.angner@philosophy.su.se*
Axiom 4.19 (The AND rule) If $A$ and $B$ are independent, then $\Pr(A \& B) = \Pr(A) \cdot \Pr(B)$.

Definition 4.32 (Conditional probability) $\Pr(A \mid B) = \frac{\Pr(A \& B)}{\Pr(B)}$.

Proposition 4.34 (The general AND rule) $\Pr(A \& B) = \Pr(A \mid B) \cdot \Pr(B)$.

Proposition 4.39 (The rule of total probability) $\Pr(D) = \Pr(D \mid B) \cdot \Pr(B) + \Pr(D \mid \neg B) \cdot \Pr(\neg B)$.

Proposition 4.42 (Bayes’s rule) $\Pr(B \mid D) = \frac{\Pr(D \mid B) \cdot \Pr(B)}{\Pr(D \mid B) \cdot \Pr(B) + \Pr(D \mid \neg B) \cdot \Pr(\neg B)}$.

The heuristics-and-biases program

Heuristics are functional but imperfect rules of thumb that can be used when forming judgments:

- The anchoring-and-adjustment heuristic instructs you to pick an initial estimate (anchor) and adjust the initial estimate up or down (as you see fit) in order to come up with a final answer.
- The representativeness heuristic tells you to estimate the probability that some outcome was the result of a given process by reference to the degree to which the outcome is representative of that process.
- The availability heuristic makes you assess the probability that some event will occur based on the ease with which the event comes to mind.
- The affect heuristic gets you to assign probabilities to consequences based on how you feel about the thing they would be consequences of: the better you feel about it, the higher the probability of good consequences and the lower the probability of bad.

Because the heuristics are imperfect, they can lead to bias: systematic and predictable error.

Chapter 6

Definition 6.9 (Expected value)

$$EV(A_i) = \Pr(S_1) \cdot C_{i1} + \Pr(S_2) \cdot C_{i2} + \ldots + \Pr(S_n) \cdot C_{in} = \sum_{j=1}^{n} \Pr(S_j) \cdot C_{ij}.$$  

Definition 6.21 (Expected utility)

$$EU(A_i) = \Pr(S_1) \cdot u(C_{i1}) + \Pr(S_2) \cdot u(C_{i2}) + \ldots + \Pr(S_n) \cdot u(C_{in}) = \sum_{j=1}^{n} \Pr(S_j) \cdot u(C_{ij}) .$$

Chapter 7

Definition 7.30 (Value)

$$V(A_i) = \pi [\Pr(S_1)] \cdot v(C_{i1}) + \pi [\Pr(S_2)] \cdot v(C_{i2}) + \ldots + \pi [\Pr(S_n)] \cdot v(C_{in}) = \sum_{j=1}^{n} \pi [\Pr(S_j)] \cdot v(C_{ij}) .$$
Prospect theory

The central components of prospect theory are the value function (Figure 7.2) and the probability weighting function (Figure 7.6).

![Figure 7.2: The value function](image1)

![Figure 7.6: The probability-weighting function π()](image2)

Chapter 8

Definition 8.10 (The delta function)

\[ U^0(u) = u_0 + \delta u_1 + \delta^2 u_2 + \delta^3 u_3 + \ldots = u_0 + \sum_{i=1}^{\infty} \delta^i u_i. \]

Discount factors vs. discount rates

To convert a discount factor \( \delta \) into a discount rate \( r \), or vice versa, apply one of the following formulas:

\[ r = \frac{1 - \delta}{\delta} \quad \delta = \frac{1}{1 + r} \]

Chapter 9

Definition 9.1 (The beta-delta function)

\[ U^0(u) = u_0 + \beta \delta u_1 + \beta \delta^2 u_2 + \beta \delta^3 u_3 + \ldots = u_0 + \sum_{i=1}^{\infty} \beta \delta^i u_i. \]

Chapter 11

Social preferences

<table>
<thead>
<tr>
<th>Preferences</th>
<th>Example functional form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altruistic</td>
<td>( u(x, y) = \frac{3}{5} \sqrt{x} + \frac{2}{5} \sqrt{y} )</td>
</tr>
<tr>
<td>Envious</td>
<td>( u(x, y) = \sqrt{x} - \sqrt{y} )</td>
</tr>
<tr>
<td>Rawlsian</td>
<td>( u(x, y) = \min(\sqrt{x}, \sqrt{y}) )</td>
</tr>
<tr>
<td>Inequality-averse</td>
<td>( u(x, y) = -</td>
</tr>
<tr>
<td>Utilitarian</td>
<td>( u(x, y) = \sqrt{x} + \sqrt{y} )</td>
</tr>
</tbody>
</table>