Corrections for Cognitive Choice Modeling

1. Wiener was misspelled as Weiner throughout the book.
2. Table 2.3 on page 19.

We should have made $xK = $10K < $15K instead of $20K.

Then *w*M = (+1/6) ($K/Kmiles) which get multiplied by negative Kmiles.

Switching to positive K miles instead, that would be the same as *w*M = (-1/6)\*($K/Kmiles) which get multiplied by positive Kmiles as shown in Table 2.2. See corrected text at end of these corrections.

1. Figure 2.1 on page 21. The Figure description should have *v*(*x*) = 1 – *x*.5. In other words, the exponent should be ½ and not 5.
2. Page 39. The utilities being summed on the right hand side of the greater than sign in the SEU equation on the top of the page should have *u*(*y*,). In other words, change *x*j to *yj* in the second sum.
3. Page 246. The equation for the unitary *U* near the bottom of the page should have the coefficient (rc/2) and not (rc2) .

**18 Chapter 2**

**Table 2.2**

Used car purchasing decision\*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Option | Mileage | Miles/Gallon | Price | Utility |
| Car A | *wM* = 1/6 100K miles | *wG* = ½ 25 | *wp* = 1  $15K | Weighted sum  -$19.17K |
| Car B | 120K miles | 22 | $14K | -$23.0K |
| Car C | 135K miles | 22 | $12K | -$23.5 |
| Car D | 90K miles | 23 | $16K | -$19.5 |
| Car E | 120K miles | 21 | $14K | -$23.5 |

What do the weights *wj* represent? This is an important question, which is answered next.

Later, we will show how the weights are determined.

Weights as exchange rates. To understand the purpose of the weights, con- sider the example shown in table 2.2. Suppose that you are making a choice from a number of used cars. Each row describes one of these cars in terms of three attributes: mileage (i.e., the number of miles on the used car), miles per gallon (an accurate average estimated by the previous user) and the price in dollars. To keep the problem simple, suppose that these cars are all the same make and same year, and the cars are pretty much equivalent in all other attributes (otherwise, we would need to include them in a bigger table).

The weighted additive value model combines the values of the three attributes by adding the values within a row. However, the problem is that the units are not comparable across the attributes. You need to change the units of each attribute into a common currency before adding them.

You could choose any column for the common value scale, but the most natural column is Price. Therefore, you need to determine the exchange rate for miles per gallon and for mileage into dollars. That is, how much money are you willing to pay for a unit change in miles per gallon, and similarly for mileage? Once we know the exchange rate for an attribute, you can multiply this exchange rate by the attribute value of an option to produce the utility for that attribute and option.

The exchange rate for each attribute may depend on the person. One way to determine a person’s exchange rate is to pose the following simpler problem, shown in table 2.3. Here, we have a choice between two options, and we assume that they are equivalent in all attributes except the two shown in the table. You can ask yourself—what value must $*x*K be such that

**Utility Theory 19**

**Table 2.3**

Figuring the exchange rate for mileage

|  |  |  |
| --- | --- | --- |
|  | Mileage | Price |
| Car Y | 100K | $15K |
| Car X | 130K | $*x*K |

You would be indifferent between Car X and Car Y? Suppose that the answer is $10K. Then you can determine the exchange rate

as follows (assuming that our preferences are based on the additive utility rule):

*u*(*Y* ) = (–100 *K* miles) × *wM* + (–$15*K*)

*u*(*X*) = (–130 *K* miles) × *wm* + (–$10 *K*)

(setting $*xK* = $10*K* to make us indifferent).

On the assumption that you are indifferent between these two when

$*xK* = $10*K*, you solve for *wM* as follows:

(–100 *K* miles) × *wM* + (–$15*K*) = (–130 *K* miles) × *wM* + (–$10 *K*)

($5*K*) = 1 $*K*

*w* =

*M* 30 *K* miles 6 *K* miles .

You also need the exchange rate for miles per gallon. Suppose that you used a similar procedure and found that *wG* = ½ (*K* dollars per mpg). Then, for instance, you can compute the value for option A using the weighted added formula

*u*( *A*) = 1 $*K* (–100*K* miles) + 1 $*K* (25 *mpg* ) – $15*K* = – $19.17*K*.

6 *K* miles 2 *mpg*

More generally, you can compute the weighted additive value for each option using the formula

*u*(*X*) = *wM* × *vM* (*X*) + *wG* × *vG* (*X*) + *wP* × *vP* (*X*),

where *vM*(*X*) is the value of Car X on attribute *M* (mileage), *vG*(*X*) is the value of Car X on attribute *G* (mpg), *wM* is the exchange rate for mileage, *wG* is the exchange rate for miles per gallon, and *wP* = -1 by default. The last column of table 2.2 shows the utility for each option in dollars. If you used this model to guide your preference, then you should choose Car A, which has the maximum value (i.e., the least negative, in this case of cost).

-1

0

+1