

## MS Module 23 Balance principle additive model practice exam questions

(The attached PDF file has better formatting.)

[The practice problems in the 24 modules explain the statistical procedures; the practice exam questions in this thread shows what you will be asked on the final exam.]

The mean values and the number of observations in each cell of a 2 × 2 classification table are

<i>Means</i>	<i>Column 1</i>	<i>Column 2</i>	<i>Observations</i>	<i>Column 1</i>	<i>Column 2</i>
<i>Row 1</i>	79	58	<i>Row 1</i>	14	15
<i>Row 2</i>	31	12	<i>Row 2</i>	11	18

*Illustration:* The cell in row 1 column 1 has a mean of 79 from a sample of 14 observations.

An actuary is setting class relativities for insurance pricing using an additive model and the balance principle. The mean value of the cell with row (j) and column (k) = base rate + row relativity (j) + column relativity (k).

The base rate is 10, and the initial column relativities are 18 for Column 1 and 0 for Column 2.

Question 23.1: Balance principle additive model implied relativity row 1

What is the implied relativity for Row 1, using the initial relativities by column?

Answer 23.1:  $(79 \times 14 + 58 \times 15 - (14 \times (10 + 18) + 15 \times (10 + 0))) / (14 + 15) = 49.448$

(implied relativity for row 1 = observed value for row 1 – expected value for row 1 with no relativity)

Question 23.2: Balance principle additive model implied relativity row 2

What is the implied relativity for Row 2, using the initial relativities by column?

Answer 23.2:  $(31 \times 11 + 12 \times 18 - (11 \times (10 + 18) + 18 \times (10 + 0))) / (11 + 18) = 2.379$

(implied relativity for row 2 = observed value for row 2 – expected value for row 2 with no relativity)

Question 23.3: Balance principle additive model implied relativity column 1

What is the implied relativity for Column 1, using the computed relativities by row?

Answer 23.3:  $(79 \times 14 + 31 \times 11 - (14 \times (10 + 49.448) + 11 \times (10 + 2.379))) / (14 + 11) = 19.142$

(implied relativity for column 1 = observed value for column 1 – expected value for column 1 with no relativity)

Question 23.4: Balance principle additive model implied relativity column 2

What is the implied relativity for Column 2, using the computed relativities by row?

Answer 23.4:  $(58 \times 15 + 12 \times 18 - (15 \times (10 + 49.448) + 18 \times (10 + 2.379))) / (15 + 18) = -0.865$

(implied relativity for column 2 = observed value for column 2 – expected value for column 2 with no relativity)