

Iterative Proportional Fitting For A Three-Dimensional Table

By

Eddie Hunsinger
Demographer

Alaska Department of Labor and Workforce Development

May 2008

What Is IPF?: 3-D

This set of slides follows 'Iterative Proportional Fitting For A Two-Dimensional Table.'

If you understand the information in those slides, you should be prepared for the information in these slides.

What Is IPF?: 3-D

First: What defines the number of dimensions on a table of data?

The number of dimensions on a table of data may be understood as the number of variables that are represented in the table.

A two-dimensional table would include a tabulation such as 'Sex by Age' (two one-dimensional variables)...

What Is IPF?: 3-D

A three-dimensional table has three sides, or marginals, as in a cube. A tabulation such as 'Age by Sex by Race' would be a three-dimensional table.

While there are two one-dimensional marginals for a two-dimensional table, there are three two-dimensional marginals for a three-dimensional table (again, as in a cube).

Deming and Stephan described the three marginals as rows, columns and slices.

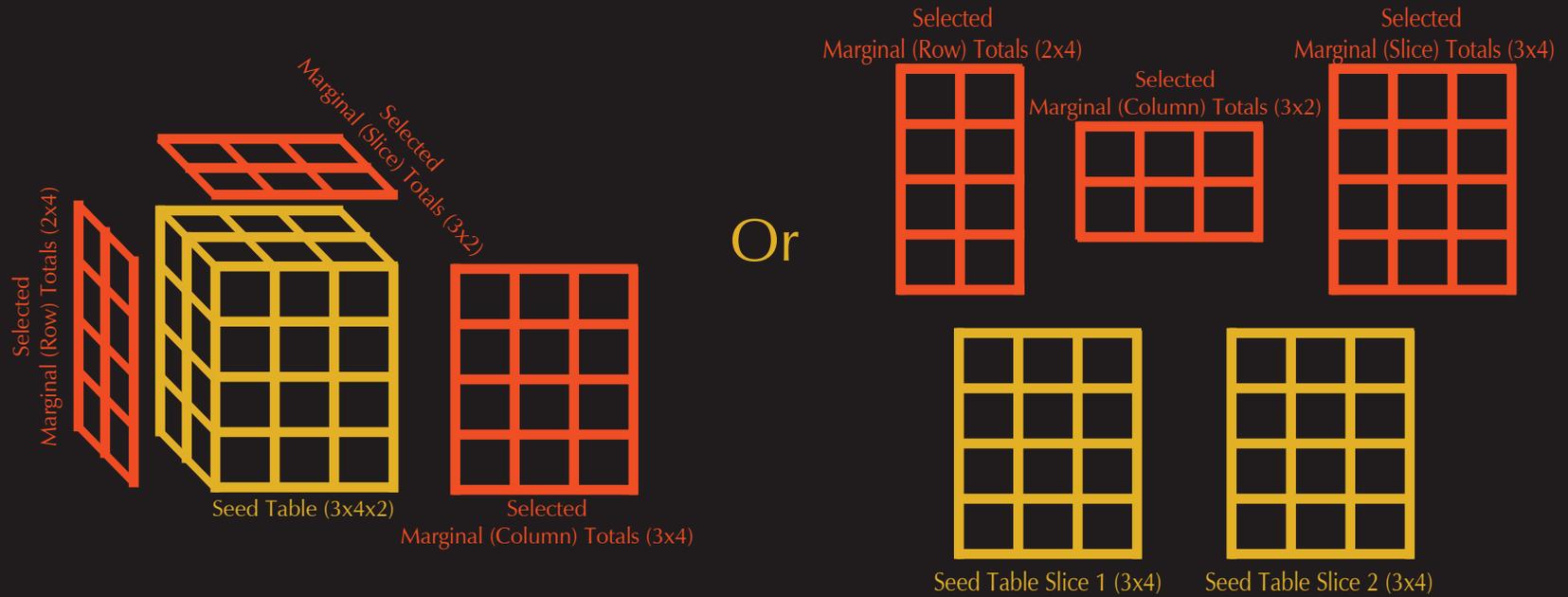
What Is IPF?: 3-D

For an Age by Sex by Race table, the marginals include (order doesn't matter here):

Age by Sex (rows of a cube)
Age by Race (columns of a cube)
Sex by Race (slices of a cube)

The next slide will show what the cells of a three-dimensional table and its marginals would look like...

What Is IPF?: 3-D



How To Do IPF?: 3-D

First, just as in two-dimensional IPF, you will need all of the marginals (e.g. Age by Sex, Age by Race, and Sex by Race), and each marginal must sum to the same value. You must also be sure that the dimensions of the marginals are consistent (e.g. that the values for the age groups are consistent).

Second, you will need a three-dimensional (e.g. Age by Sex by Race) seed.

You will then perform steps that are very similar to the two-dimensional case...

How To Do IPF?: 3-D

Step 1: Proportionally adjust each (two-dimensional) row of cells to equal the pre-determined totals of Marginal 1.

Step 2: Proportionally adjust each column of cells to equal the pre-determined totals of Marginal 2.

Steps 3: Proportionally adjust each slice of cells to equal the pre-determined totals of Marginal 3. This is the end of the first 'Iteration'.

Steps 4 and higher: Repeat the above steps until the desired level of convergence is reached.

Make Sense? If Not:

Here is a link to three-dimensional IPF done step-by-step in a simple Excel spreadsheet (just follow the 'Iteration' numbers).

And here, again, is that link and reference to Deming and Stephan's paper describing the procedure (see pp 439-442).

Deming, W. and Stephan, F. (1940) 'On least square adjustment of sampled frequency tables when the expected marginal totals are known.' *Ann. Math. Statist.*, 6, 427–444.

The same 'important points' described in 'Iterative Proportional Fitting For A Two-Dimensional Table' apply for the three-dimensional case.

The End

So that's all I have to tell about IPF for a three-dimensional table.

[Here is a link to my web page with more IPF information.](#)