Sep 03, 07 4:55 **x8_4.sas** Page 1/1

```
/* x8_4.sas */
/* Purpose:  */

title1 'Example 8.4';

data a;
input x1 x2 x3 x4 x5 x6 x7 box$;
cards;
 3.76    3.66    0.54     5.275     9.768    13.741    4.782  a
 8.59    4.99    1.34    10.022     7.500    10.162    2.130  b
 6.22    6.14    4.52     9.842     2.175     2.732    1.089  c
 7.57    7.28    7.07    12.662     1.791     2.101    0.822  d
 9.03    7.08    2.59    11.762     4.539     6.217    1.276  e
 5.51    3.98    1.30     6.924     5.326     7.304    2.403  f
 3.27    0.62    0.44     3.357     7.629     8.838    8.389  g
 8.74    7.00    3.31    11.675     3.529     4.757    1.119  h
 9.64    9.49    1.03    13.567    13.133    18.519    2.354  i
 9.73    1.33    1.00     9.871     9.871    11.064    3.704  j
 8.59    2.98    1.17     9.170     7.851     9.909    2.616  k
 7.12    5.49    3.68     9.716     2.642     3.430    1.189  l
 4.69    3.01    2.17     5.983     2.760     3.554    2.013  m
 5.51    1.34    1.27     5.808     4.566     5.382    3.427  n
 1.66    1.61    1.57     2.799     1.783     2.087    3.716  o
 5.90    5.76    1.55     8.388     5.395     7.497    1.973  p
 9.84    9.27    1.51    13.604     9.017    12.668    1.745  q
 8.39    4.92    2.54    10.053     3.956     5.237    1.432  r
 4.94    4.38    1.03     6.678     6.494     9.059    2.807  s
 7.23    2.30    1.77     7.790     4.393     5.374    2.274  t
 9.46    7.31    1.04    11.999    11.579    16.182    2.415  u
 9.55    5.35    4.25    11.742     2.766     3.509    1.054  v
 4.94    4.52    4.50     8.067     1.793     2.103    1.292  w
 8.21    3.08    2.42     9.097     3.753     4.657    1.719  x
 9.41    6.44    5.11    12.495     2.446     3.103    0.914  y
;
proc print data=a;
title2 'List of data.';

proc factor data=a simple nfactors=2 rotate=varimax score out=b;
  var x1-x7;
title2 'Principal factor analysis - 2 factors, varimax rotation + scores.';

proc print data=b;
  var x1 x2 x3 factor1 factor2;
title2 'List of data (X1 X2 X3) and factor scores (FACTOR1 FACTOR2).';
title3 'Note: SAS does not compute the scores as in the example in the book.';

proc plot data=b;
  plot factor2*factor1=box;
title2 'Plot of boxes using transformed variables.';

run;
```

Example 8.4 1
List of data.

Obs	x1	x2	x3	x4	x5	x6	x7	box
1	3.76	3.66	0.54	5.275	9.768	13.741	4.782	a
2	8.59	4.99	1.34	10.022	7.500	10.162	2.130	b
3	6.22	6.14	4.52	9.842	2.175	2.732	1.089	c
4	7.57	7.28	7.07	12.662	1.791	2.101	0.822	d
5	9.03	7.08	2.59	11.762	4.539	6.217	1.276	e
6	5.51	3.98	1.30	6.924	5.326	7.304	2.403	f
7	3.27	0.62	0.44	3.357	7.629	8.838	8.389	g
8	8.74	7.00	3.31	11.675	3.529	4.757	1.119	h
9	9.64	9.49	1.03	13.567	13.133	18.519	2.354	i
10	9.73	1.33	1.00	9.871	9.871	11.064	3.704	j
11	8.59	2.98	1.17	9.170	7.851	9.909	2.616	k
12	7.12	5.49	3.68	9.716	2.642	3.430	1.189	l
13	4.69	3.01	2.17	5.983	2.760	3.554	2.013	m
14	5.51	1.34	1.27	5.808	4.566	5.382	3.427	n
15	1.66	1.61	1.57	2.799	1.783	2.087	3.716	o
16	5.90	5.76	1.55	8.388	5.395	7.497	1.973	p
17	9.84	9.27	1.51	13.604	9.017	12.668	1.745	q
18	8.39	4.92	2.54	10.053	3.956	5.237	1.432	r
19	4.94	4.38	1.03	6.678	6.494	9.059	2.807	s
20	7.23	2.30	1.77	7.790	4.393	5.374	2.274	t
21	9.46	7.31	1.04	11.999	11.579	16.182	2.415	u
22	9.55	5.35	4.25	11.742	2.766	3.509	1.054	v
23	4.94	4.52	4.50	8.067	1.793	2.103	1.292	w
24	8.21	3.08	2.42	9.097	3.753	4.657	1.719	x
25	9.41	6.44	5.11	12.495	2.446	3.103	0.914	y

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Example 8.4 2
Principal factor analysis - 2 factors, varimax rotation + scores.

The FACTOR Procedure

Means and Standard Deviations from 25 Observations

Variable	Mean	Std Dev
x1	7.1000000	2.3238026
x2	4.7732000	2.4177860
x3	2.3488000	1.6655613
x4	9.1338400	3.0178197
x5	5.4582000	3.2732691
x6	7.1674400	4.5580886
x7	2.3461600	1.6105014

Example 8.4 3
Principal factor analysis - 2 factors, varimax rotation + scores.

The FACTOR Procedure
Initial Factor Method: Principal Components

Prior Communality Estimates: ONE

Eigenvalues of the Correlation Matrix: Total = 7 Average = 1

	Eigenvalue	Difference	Proportion	Cumulative
1	3.39464225	0.58916459	0.4849	0.4849
2	2.80547765	2.36816685	0.4008	0.8857
3	0.43731080	0.15936357	0.0625	0.9482
4	0.27794723	0.19699468	0.0397	0.9879
5	0.08095255	0.07754549	0.0116	0.9995
6	0.00340706	0.00314459	0.0005	1.0000
7	0.00026247		0.0000	1.0000

2 factors will be retained by the NFACTOR criterion.

Factor Pattern

	Factor1	Factor2
x1	0.74673	0.49059
x2	0.79517	0.37258
x3	0.71016	-0.59609
x4	0.90997	0.38904
x5	-0.23530	0.96328
x6	-0.17836	0.97148
x7	-0.88611	0.21824

Variance Explained by Each Factor

Factor1	Factor2
3.3946422	2.8054777

Final Communality Estimates: Total = 6.200120

x1	x2	x3	x4
0.79829189	0.77111321	0.85964214	0.97940083

x5	x6	x7
0.98326505	0.97558652	0.83282025

```
                     Example 8.4                                    4
  Principal factor analysis - 2 factors, varimax rotation + scores.

                   The FACTOR Procedure
                 Rotation Method: Varimax

              Orthogonal Transformation Matrix

                                 1               2

                    1         0.92099        -0.38960
                    2         0.38960         0.92099


                   Rotated Factor Pattern

                        Factor1         Factor2

              x1         0.87886         0.16091
              x2         0.87750         0.03335
              x3         0.42181        -0.82566
              x4         0.98964         0.00378
              x5         0.15858         0.97883
              x6         0.21422         0.96421
              x7        -0.73107         0.54622


              Variance Explained by Each Factor

                    Factor1         Factor2

                  3.3052161       2.8949038


        Final Communality Estimates: Total = 6.200120

         x1              x2              x3              x4

     0.79829189      0.77111321      0.85964214      0.97940083

                 x5              x6              x7

             0.98326505      0.97558652      0.83282025
```



```
                     Example 8.4                                    5
  Principal factor analysis - 2 factors, varimax rotation + scores.

                   The FACTOR Procedure
                 Rotation Method: Varimax

           Scoring Coefficients Estimated by Regression


    Squared Multiple Correlations of the Variables with Each Factor

                    Factor1         Factor2

                  1.0000000       1.0000000


              Standardized Scoring Coefficients

                        Factor1         Factor2

              x1         0.27072         0.07535
              x2         0.26747         0.03105
              x3         0.10989        -0.27719
              x4         0.30091         0.02328
              x5         0.06993         0.34323
              x6         0.08652         0.33939
              x7        -0.21010         0.17334

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                     Example 8.4                                    6
    List of data (X1 X2 X3) and factor scores (FACTOR1 FACTOR2).
   Note: SAS does not compute the scores as in the example in the book.

         Obs      x1       x2       x3      Factor1      Factor2

           1     3.76     3.66     0.54    -1.11728      1.35221
           2     8.59     4.99     1.34     0.34823      0.63964
           3     6.22     6.14     4.52     0.27222     -1.17669
           4     7.57     7.28     7.07     1.01969     -1.63689
           5     9.03     7.08     2.59     0.85994     -0.21000
           6     5.51     3.98     1.30    -0.57017      0.09818
           7     3.27     0.62     0.44    -2.31784      1.09799
           8     8.74     7.00     3.31     0.82732     -0.57244
           9     9.64     9.49     1.03     1.55115      2.04745
          10     9.73     1.33     1.00    -0.09891      1.17021
          11     8.59     2.98     1.17    -0.03101      0.70582
          12     7.12     5.49     3.68     0.24735     -0.90533
          13     4.69     3.01     2.17    -0.88456     -0.68318
          14     5.51     1.34     1.27    -1.16179     -0.05193
          15     1.66     1.61     1.57    -2.02038     -0.75250
          16     5.90     5.76     1.55    -0.10412      0.07869
          17     9.84     9.27     1.51     1.46592      1.03871
          18     8.39     4.92     2.54     0.32131     -0.38066
          19     4.94     4.38     1.03    -0.62911      0.42450
          20     7.23     2.30     1.77    -0.47803     -0.19459
          21     9.46     7.31     1.04     1.04781      1.66946
          22     9.55     5.35     4.25     0.77634     -0.90321
          23     4.94     4.52     4.50    -0.28101     -1.31441
          24     8.21     3.08     2.42    -0.05924     -0.43112
          25     9.41     6.44     5.11     1.01616     -1.10992
```

```
                                  Example 8.4                                  7
                   Plot of boxes using transformed variables.

               Plot of Factor2*Factor1.  Symbol is value of box.

Factor2 |
        |
    2.5 +
        |
        |
        |
        |
    2.0 +                                                                i
        |
        |
        |                                                         u
        |
    1.5 +
        |                          a
        |
        |                                         j
        |          g
    1.0 +                                                               q
        |
        |
        |                                          k
        |                                               b
    0.5 +
        |                                 s
        |
        |
        |                                  f      p
    0.0 +
        |                          n
        |                                   t                  e
        |
        |                                         x    r
   -0.5 +
        |                                                      h
        |                              m
        |              o
        |                                             l       v
   -1.0 +
        |                                                        y
        |                                              c
        |                                      w
        |
   -1.5 +
        |                                                        d
        |
        |
        |
   -2.0 +
        |
        -+-------------+-------------+-------------+-------------+-------------+
        -3            -2            -1             0             1             2

                                         Factor1
```