Classical Test Item Analysis

Classical item analysis is used to estimate the reliability of test scores obtained from measures of subjects on some attribute such as achievement, aptitude or intelligence. In classical test theory, the obtained score for an individual on items is theorized to consist of a "true score" component and an "error score" component. Errors are typically assumed to be normally distributed with a mean of zero over all the subjects measured.

Several methods are available to estimate the reliability of the measures and vary according to the assumptions made about the scores. The Kuder-Richardson estimates are based on the product-moment correlation (or covariance) among items of the observed test scores and those of a theoretical "parallel" test form. The Cronbach and Hoyt estimates utilize a treatment by subjects analysis of variance design which yields identical results to the KR#20 method when item scores are dichotomous (0 and 1) values.

When you select the Classical Item Analysis procedure you will use the following dialogue box to specify how your test is to be analyzed. If the test consists of multiple sub-tests, you may define a scale for each sub-test by specifying those items belonging to each sub-test. The procedure will need to know how to determine the correct and incorrect responses. If your data are already 0 and 1 scores, the most simple method is to simply include, as the first record in your file, a case with 1's for each item. If your data consists of values ranging, say, between 1 and 5 corresponding to alternative choices, you will either include a first case with the correct choice values or indicate you wish to Prompt for Correct Responses (as numbers when values are numbers.) If items are to be assigned different weights, you can assign those weights by selecting the "Assign Item Weights scoring option. The scored item matrix will be printed if you elect it on the output options. Three different reliability methods are available. You can select them all if you like.

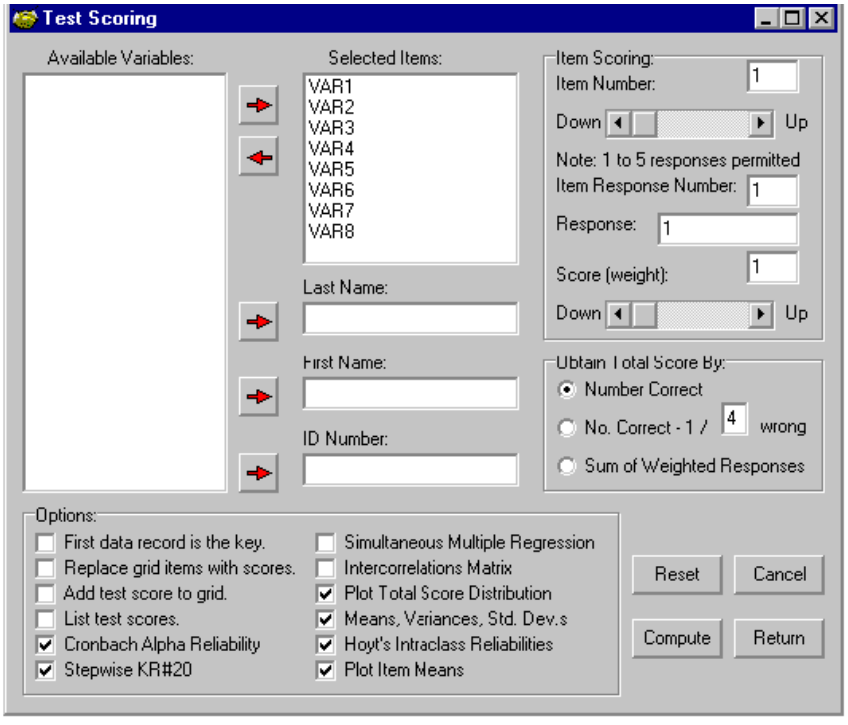

Figure 1 Classical Item Analysis Dialog

Shown below is a sample output obtained from the Classical Item Analysis procedure followed by an item characteristic curve plot for one of the items.

Alpha Reliability Estimate for Test = 0.8767 S.E. of Measurement = 0.891
Means with 17 valid cases.

Variables	VAR1	VAR2	VAR3	VAR4	VAR5
	0.941	0.824	0.706	0.588	0.471

Variables	VAR6	VAR7	VAR8	TOTAL
	0.353	0.235	0.118	4.235

Variances with 17 valid cases.

Variables	VAR1	VAR2	VAR3	VAR4	VAR5
	0.059	0.154	0.221	0.257	0.265

Variables	VAR6	VAR7	VAR8	TOTAL
	0.243	0.191	0.110	6.441

Standard Deviations with 17 valid cases.

Variables	VAR1	VAR2	VAR3	VAR4	VAR5
	0.243	0.393	0.470	0.507	0.514

Variables	VAR6	VAR7	VAR8	TOTAL
	0.493	0.437	0.332	2.538

Analysis of Variance for Hoyt Reliabilities

SOURCE	D.F.	SS	MS	F	PROB
Subjects	16	12.88	0.81	8.11	0.00
Within	119	21.00	0.18		
Items	7	9.88	1.41	14.22	0.00
Error	112	11.12	0.10		
Total	135	33.88			

Hoyt Unadjusted Test Rel. for scale TOTAL = 0.7808 S.E. of Measurement = 1.188
Hoyt Adjusted Test Rel. for scale TOTAL = 0.8767 S.E. of Measurement = 0.891
Hoyt Unadjusted Item Rel. for scale TOTAL = 0.3081 S.E. of Measurement = 2.111
Hoyt Adjusted Item Rel. for scale TOTAL = 0.4706 S.E. of Measurement = 1.847

KR#20 = 0.8819 for the test with mean = 1.059 and variance = 0.934

Item	Mean	Variance	Pt.Bis.r
4	0.588	0.257	0.9449
5	0.471	0.265	0.9465

KR#20 = 0.8906 for the test with mean = 1.412 and variance = 1.882

Item	Mean	Variance	Pt.Bis.r
4	0.588	0.257	0.8874
5	0.471	0.265	0.9479
6	0.353	0.243	0.8813

KR#20 = 0.8933 for the test with mean = 2.118 and variance = 2.985

Item	Mean	Variance	Pt.Bis.r
4	0.588	0.257	0.9144
5	0.471	0.265	0.9181
6	0.353	0.243	0.8294
3	0.706	0.221	0.8155

KR#20 = 0.8929 for the test with mean = 2.353 and variance = 4.118

Item	Mean	Variance	Pt.Bis.r
4	0.588	0.257	0.8786
5	0.471	0.265	0.9085
6	0.353	0.243	0.8680

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  3    0.706   0.221     0.7715
  7    0.235   0.191     0.7459
KR#20 = 0.8902 for the test with mean =  3.176 and variance =  5.154
Item  Mean    Variance   Pt.Bis.r
  4    0.588   0.257     0.8810
  5    0.471   0.265     0.8876
  6    0.353   0.243     0.8350
  3    0.706   0.221     0.8137

  7    0.235   0.191     0.7111
  2    0.824   0.154     0.6676
KR#20 = 0.8851 for the test with mean =  3.294 and variance =  5.971
Item  Mean    Variance   Pt.Bis.r
  4    0.588   0.257     0.8601
  5    0.471   0.265     0.8773
  6    0.353   0.243     0.8430
  3    0.706   0.221     0.7881
  7    0.235   0.191     0.7502
  2    0.824   0.154     0.6433
  8    0.118   0.110     0.5708
KR#20 = 0.8767 for the test with mean =  4.235 and variance =  6.441
Item  Mean    Variance   Pt.Bis.r

  4    0.588   0.257     0.8567
  5    0.471   0.265     0.8672
  6    0.353   0.243     0.8293
  3    0.706   0.221     0.7958
  7    0.235   0.191     0.7355
  2    0.824   0.154     0.6709
  8    0.118   0.110     0.5583
  1    0.941   0.059     0.4300
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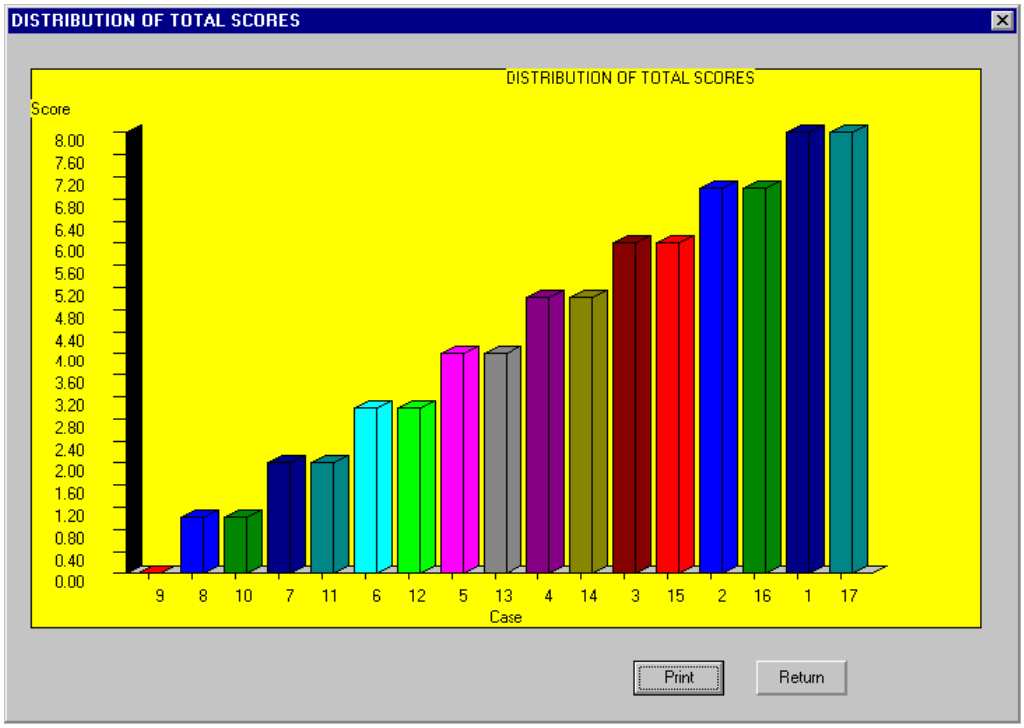
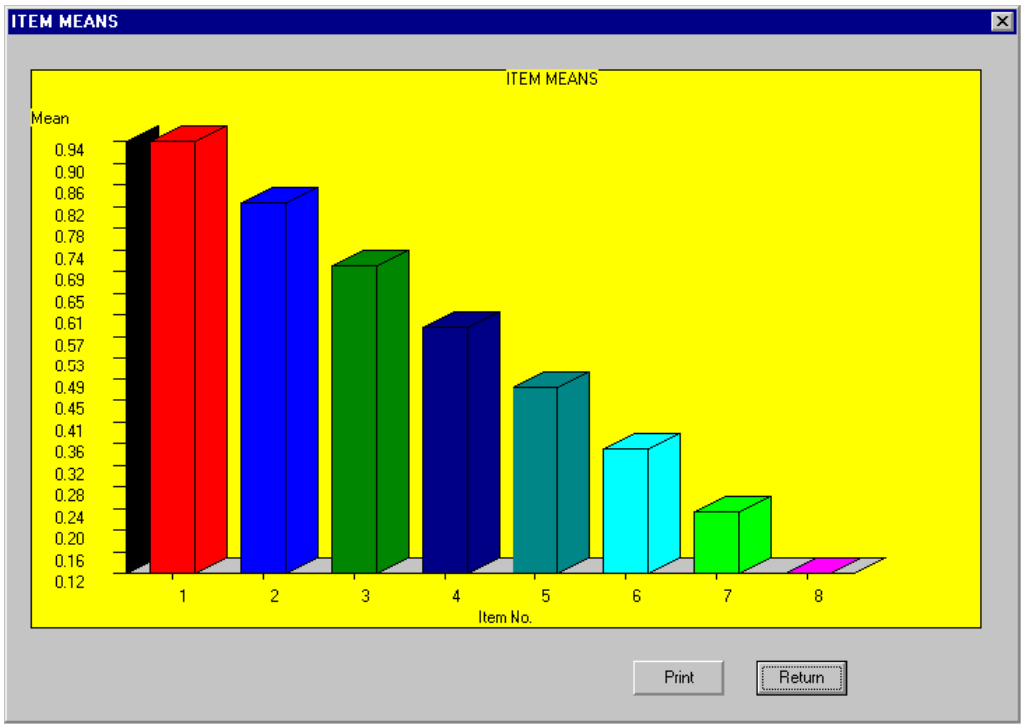


Figure 2 Distribution of Test Scores (Classical Analysis)


ITEM MEANS
ITEM MEANS
Mean
0.94
0.90
0.86
0.82
0.78
0.74
0.69
0.65
0.61
0.57
0.53
0.49
0.45
0.41
0.36
0.32
0.28
0.24
0.20
0.16
0.12
1
2
3
4
5
6
7
8
Item No.
Print
Return