Nonparametric Statistics

Merle Canfield

 This chapter deals with the variations of the correlation coefficient and nonparametric statistical procedures. Comparisons will be made between various parametric and nonparametric statistics. The first type of correlation presented is the Pearson Correlation Coefficient (when we indicate a correlation we are usually referring to the Pearson).

The first set data to be used for the examples that follows:

 Chitest1.sav

 X Y

 1 1

 1 1

 1 1

 1 1

 1 1

 2 2

 2 2

 2 2

 2 2

 2 2

 3 3

 3 3

 3 3

 3 3

 3 3

 4 4

 4 4

 4 4

 4 4

 4 4

 5 5

 5 5

 5 5

 5 5

 5 5

Correlation formula calculation

The following clicks will produce the resulting Syntax File

Open chitest1.sav in SPSS

Click on Analyze

Click on Correlate

Click on Bivariate

Select both X and Y Variables

Click on right delta button

Click on Options

Select Means and Standard Deviations

Click Continue

Click Paste

Click Run

Click All

The above clicks will produce the following syntax file and output

|  |
| --- |
| Corr1.sps |
| DATASET ACTIVATE DataSet1.CORRELATIONS /VARIABLES=x y /PRINT=TWOTAIL NOSIG /STATISTICS DESCRIPTIVES XPROD /MISSING=PAIRWISE. |

Save syntax file as corr1.sps

Descriptive Statistics

 Mean Std. Deviation N

X 3.0000 1.4434 25

Y 3.0000 1.4434 25

Correlations

 X Y

X Pearson Correlation 1.000 1.000

 Sig. (2-tailed) . .000

 N 25 25

Y Pearson Correlation 1.000 1.000

 Sig. (2-tailed) .000 .

 N 25 25

\*\* Correlation is significant at the 0.01 level (2-tailed).

Two types of Nonparmetric Procedures (Correlational & Test group differences)

A. Nonparametric Correlation Procedures

 There are a number of nonparmetric correlation procedures. The differences among these procedures occur mostly because the measurement of the variables have different scales. Consequently, a description of the measurement follows. Naming, counting, categorizing, and measuring are different levels of distinguishing along some continuum. Naming or numbering different people can identify them but does not give an indication of greater or lesser on any dimension. The same for categorizing. Ranking implies a greater than or lesser. An amount implies greater than or less than and also gives and indication of how much more than or less than. In psychological measurement there are usually four levels of measurement considered:

1. *Nominal* Simply naming things but does indicate that if it this then it not that. Social security number, ID number, ethnicity, and DSMIV diagnosis are examples of the nominal scale.
2. *Ordinal*. Indicates ranking—some item is greater or less than another item. No indication of amount of difference. House number, socioeconomic status, and any ranking procedures are examples of the ordinal scale.
3. *Interval* Indicates greater or less than and also an equal amount of difference between each item (number). Numbers indicate the degree of difference between items. Temperature is the most example of an interval scale. Many measurements are treated as if they are interval but not all agree that they are interval. Such scales are IQ, achievement scales, and attitude scales. For example, the Likert scale of Strongly Agree (5), Agree (4), Neutral (3), Disagree (2), and Strongly Disagree (1) is usually treated as interval. However, there can be debate as to whether the distance between Disagree (2) and Strongly Disagree (1) is the same distance as the difference between Agree (4) and Neutral (3) (the assumption of an interval scale).
4. *Ratio* The ratio scale has an absolute zero. There are probably no scales in the psychology the meet the requirements of a ratio scale.

Nonparametric procedures allows one to correlate variables when their scales are nominal and ordinal. Consequently, nonparametric procedures are used when the scale of measurement of the data are only at the level of nominal or ordinal. The output from the various programs indicate level of measurement. The next set of clicks produces and number

Open chitest1.sav in SPSS

Click Analyze

Click Descriptive Statistics

Click Crosstabs

Select the X variable Click delta button

Select the Y variable Click delta button

Click Statistics

Select all desired statistics by clicking in the corresponding box

Click Continue

Click Paste

Click Run

Click All

Save syntax file as nonparcorr1.sps

|  |
| --- |
| File Name = nonparcorr1.sps |
| CROSSTABS TABLES=y BY x /FORMAT= AVALUE TABLES /STATISTIC=CHISQ CC PHI LAMBDA UC ETA CORR GAMMA D BTAU CTAU KAPPA RISK MCNEMAR /CELLS= COUNT . |

 The syntax file (nonparcorr1.sps) program with the data labeled "chitest1.sav' data produces the following output:

**Crosstabs [**summary of output data]





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Open chitest3.sav in SPSS

|  |
| --- |
| File Name = crscro8.sps |
|  CROSSTABS /TABLES=x BY y /FORMAT= AVALUE NOINDEX BOX LABELS TABLES /STATISTIC=CHISQ CC PHI LAMBDA UC ETA CORR GAMMA D BTAU CTAU KAPPA /CELLS= COUNT . |

 Chitest8.sav

 X Y

 1 2

 1 2

 1 2

 1 2

 1 2

 2 3

 2 3

 2 3

 2 3

 2 3

 3 4

 3 4

 3 4

 3 4

 3 4

 4 5

 4 5

 4 5

 4 5

 4 5

 5 6

 5 6

 5 6

 5 6

 5 6

**Crosstabs**











 The next analysis shows the difference between those statistics that show a linear relationship and those that show a conditional relationship. Those that retain perfect relationships are conditional while those that are less than perfect show linear relationships.

 The following syntax file and data produces the resulting output.

Open chitest2.sav in SPSS

|  |
| --- |
| File Name = crscro5.sps |
| CROSSTABS /TABLES=x BY y /FORMAT= AVALUE TABLES /STATISTIC=CHISQ CC PHI LAMBDA UC ETA CORR GAMMA D BTAU KAPPA MCNEMAR /CELLS= COUNT . |

 chitest2.sav

 X Y

 1 5

 1 5

 1 5

 1 5

 1 5

 2 2

 2 2

 2 2

 2 2

 2 2

 3 3

 3 3

 3 3

 3 3

 3 3

 4 4

 4 4

 4 4

 4 4

 4 4

 5 1

 5 1

 5 1

 5 1

 5 1

**Crosstabs**











of the two sets of data will be used to graphically show the difference betweenlinear and conditional relationship.



 **Scattergram 1 Scattergram 2**

In the two scattergrams above there are five cases for each of the circle/stars representing the data from the two examples. Scattergram 1 is generated from the data set CHITEST1 and Scattergram 2 is generated from the data set CHITEST2. For this discussion the Pearson Correlation and the Pearson Chi Square will be the examplars. The table below is a summary of other statistics representing linear or conditional relationships. Those that remain perfect relationships (for the CHITEST2 data) are conditional relationships while those that become less than perfect are linear relationships. The difference between the two can be seen in the two scattergrams. In both situations when you know the value of X then you know the value of Y. In the linear relationship there is an additional requirement that if X is higher on the scale then Y must also be higher on the scale. In Scattergram 2 that is not always the true. Where it is seen that when X is 1 the Y’s are all 2’s. The Y’s are lower. Consequently, the linear relationship does not hold in the second example. However, for conditional relationship where the only requirement is that if you know the value of X then predict that Y is a specific value then those statistics that test such a condition remain perfect. The Pearson Correlation represents the linear relationship and the Pearson Chi Square represents the conditional relationship.

|  |  |  |
| --- | --- | --- |
|  | CHITEST1 Example | CHITEST2 Example |
| Pearson Chi SquareLiklihood RatioLinear-by-Linear AssociationLambdaGoodman & Kruskal tauUncertainty CoefficientSomers’ dEtaPhiCramer’s VContingency CoefficientKendall’s tau-bKendall’s tau-cGammaSpearman CorrelationPearson’s rKappa | 100.0080.4724.001.001.001.001.001.002.001.00.891.001.001.001.001.00 | 100.0080.478.641.001.001.00-.401.002.001.00.89-.40-.40-.40-.60-.60.50 |

Notice that in the left scattergram all points are on the regression line indicating a perfect relationship using the Pearson Correlation Coefficient. In the right scattergram the Pearson will be less than perfect because not all points are on the regression line. The next computer run shows that those statistics that assume linear direction will be lowered while those that do not will remain perfect relationships (conditional probabilities).

Open chitest3.sav in SPSS

|  |
| --- |
| File Name = crscro6.sps |
| /TABLES=x BY y /FORMAT= AVALUE NOINDEX BOX LABELS TABLES /STATISTIC=CHISQ CC PHI LAMBDA UC ETA CORR GAMMA D BTAU CTAU KAPPA /CELLS= COUNT . |

 1 2

 1 2

 1 2

 1 2

 1 2

 2 1

 2 1

 2 1

 2 1

 2 1

 3 3

 3 3

 3 3

 3 3

 3 3

 4 5

 4 5

 4 5

 4 5

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 5 4

 5 4

**Crosstabs**







The Chi-square and the Likelihood Ratio remained perfect while the Linear-by-Linear Association is lower than the previous run. That indicates that the first two are conditional while the 3rd is linear as the name implies.





Chi Square, Lambda, uncertainty coefficient, Phi, Cramer’s V and the Contingency Coefficient all remain the same indicating conditional relationships. Kendall’s tau, Gamma, Spearman Correlation, Pearson’s r and Kappa were all lower indicating a linear relationshsip.

 This next example is taken from clients in a psychiatric setting and taking medications. The notion is that specific medications should be associated with diagnosis. Consequently, diagnosis is crosstabulated with medications taken.

Open stotctp.sav in SPSS

|  |
| --- |
| File Name = crscro2.sps |
| /TABLES=medicat BY diag /FORMAT= AVALUE NOINDEX BOX LABELS TABLES /STATISTIC=CHISQ CC PHI LAMBDA UC ETA CORR GAMMA D BTAU CTAU /CELLS= COUNT . |

**Crosstabs**





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 The problem with the above data is that one does not know which of the cells are significantly different. Consequently, it is not known whether the correct medications were administered to the appropriate client. Chi square only indicates that some of the cells are different from some other cells. The differences must be tested pairwise. For example, the two diagnosis “affective” and “psychotic” can be compared as to whether they are receiving “antidepressive” and “antipsychotic” medications respectively. The following examples demonstrate.

The data must first be recoded in the stotctp.sav file.

|  |
| --- |
| File name = rcdstot1.sps |
| RECODE medicat (2=1) (4=2) (ELSE=SYSMIS) INTO med2 .RECODE diag (1=1) (2=2) (ELSE=SYSMIS) INTO diag2 .EXECUTE . |

Save the file with a new name stotcptrev.sav

Then the following analysis can be computed:

Open stotcptrev.sav SPSS

|  |
| --- |
| File name = stotcro1.sps |
| CROSSTABS /TABLES=med2 BY diag2 /FORMAT= AVALUE TABLES /STATISTIC=CHISQ /CELLS= COUNT . |

**Crosstabs**

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|  |  |
| --- | --- |
| **A** | **B** |
| **C** | **D** |

 In the 2 X 2 contingency table above one can test whether there is a differential administration of medications to clients with different diagnoses. It was mentioned above that when the contingency table was large one could not determine which of the cells were significantly different from other specific cells. In the case of the 2X 2 one can make such a determination. The Chi Square will determine whether cells A and D are different that cells B and C (see small table above for reference). If cells A and D are different than cells B and C one concludes that medications of antipsychotic and antianxiety were differentially administered to clients with psychotic and affective disorders.

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1. Examples of Relationships in Psychotherapy Research

 Bales in 1950 developed the interaction process analysis (IPA) which has attracted the most research in training groups or leadership groups. The process has been constantly updated as a result of research efforts. However, the categories have remained pretty much intact since the 1950 development. The following categories are taken from the 1970 work.

 The 12 rating categories are listed along with short descriptions below.

Seems friendly - any positive act except those rated as category 3 or as category 8.

1. *Dramatizes* ‑ non‑task oriented acts which are intended for emotional appeal. Any joke or humorous remark is scored in this category.

2. *Agrees* Any act of agreement.

3. *Gives suggestion* direction, with the implication of autonomy on the other persons part.

4. *Gives opinion* the act of evaluating, analyzing, expressing feelings.

5. *Gives information* neutral, factual information is given.

6. *Asks for information* asks for neutral, factual information.

7. *Asks for opinion* asks for evaluative data or feelings.

8. *Asks for suggestion* asks for direction without evaluation.

9. *Disagrees* any act of disagreement.

10. *Shows tension*

11. *Shows antagonism*

12. *Unfriendly*

Bales, R. F. (1950). Interaction Process Analysis. Cambridge, MA: Addison-Wesley.

Bales, R. F. (1970). Personality and Interpersonal Behavior. Holt,

 Rinehart and Winston: New York.

9 CL: I hadn't thought of it that way./ I don't know if that's exactly it./ I think I'm pretty independent./

4 CO: Well, lets look at that for a minute./ You say you're independent/but when your parents tell you to do all these things, you do them./

9 CL: What else can I do?/ What choice do you think I have?/ I'm living there/and the rule is that I should do what they say as long as I live under their roof./ They might kick me out if I didn't./

4 CO: You know, when I was your age I had a very difficult time leaving home./My father had died and my mother was all alone./ I felt guilty for a long time about leaving her./I wonder if you're feeling some guilt about growing up and leaving them!/

7 CL: Well, I do feel guilty about leaving but also angry at them for making me feel this way and for treating my brother differently./ What do you think I ought to do resolve this?/

4 CO: Maybe it would a good idea to drop out of school for awhile, get a job, and make enough money to move into your own apartment./

10 CL: I've thought about that but I feel anxious that I'd never go back to school./ But you know, as I think about it, maybe the reason I have so much trouble about motivation in school is because of these conflicts with my parents./

6 CO: What do you mean?/

4 CL: Well I feel like I'm doing everything for them instead of because of I want to do it and if there's always this battle over my future, it's pretty hard for me to figure out what I want./

5 CO: When you said that, your forehead wrinkled up and you began to look tearful./

CL: (silence = 10 seconds)/

6 CO: We only a have couple of minutes left./ Where would you like to go from here with this problem?/

7 CL: Do you think it would be worthwhile to talk to someone again?/

7 CO: What do you think?/

4 CL: You've made me think about some things./I'm feeling really confused right now./ I wasn't sure before this about seeing you because I didn't know what to expect from this counseling/but you seem to understand me./ Maybe you can help me figure out some of this mess with my parents and school./

4 CO: Yeah./ It sounds like you have trouble figuring out who you are and what you want out of your life, separate from what your parents want./That certainly seems like something appropriate to talk about here in counseling./ I think it would be a good idea for you to continue to see me./

10 CL: I do feel a bit anxious talking to you because it feels like you can see right through me./

10 CO: I feel somewhat anxious right now too./I usually feel a little bit tense until I get to know a person and decide whether we can work together./I think you did the right thing by coming in at this point in your life./You'll probably feel better after talking about your concerns./

5 CL: I hope so./I think I'll go home and think about some of these things./Maybe I'll think about my options about moving out and where I could afford to live./Maybe I'll talk some to my parents about moving out./Does that sound like a good idea to you?/

8 CO: Why don't we talk through that at your next session?/We need to

Hill's (1979) counselor verbal response category system (HCVRCS) contained 14 categories. The HCVRCS meets a large part of the requirements of a broad area of human behavior and the categories used cover the range of the major psychotherapy theories. However, the categories focus on the skills of the therapist and are limited to the verbal responses of the therapist. The categories are as follows:

1. *minimal encourager* ‑ a short phrase that implies an acknowledgement or understanding of the previous response. It does not indicate approval or disapproval. Words like "um hum", "okay", "yes" would be minimal encouragers.

2. *approval‑reassurance* ‑ emotional support, approval or reinforcement.

3. *information* ‑ supplies information, data, and facts; but does not indicate what the client should do.

4. *direct guidance* ‑ gives advice and directions.

5. *closed question* ‑ data gathering that elicits short answer of confirmation.

6. *open question* ‑ a probe that asks for clarification.

7. *restatement* ‑ simple repeating or rephrasing of the clients statement.

8. *reflection* ‑ a repeating or rephrasing which also contains reference to feelings of the client.

9. *nonverbal referent* ‑ probes aspects of the client's nonverbal behavior without interpretation.

10. *interpretation* ‑ reflection which goes beyond what the client has overtly stated ‑ it might indicate themes or patterns of the clients behavior or personality.

11. *confrontation* ‑ has two parts (1) statement about the client and (2) a contradiction or discrepancy about those aspects of the client.

12. *self‑disclose* ‑ the counselor shares personal experiences or feelings with the client.

13. *silence* ‑ a pause of 5 seconds or more when its the counselor's turn.

14. *other* ‑ can't otherwise be coded.

Hill, C. E. (1988). An Overview of the Hill Counselor and Client: Verbal Response Modes Category Systems. In L.

S. Greenberg & W. M. Pinsof (Eds.),

 The Psychotherapeutic Process: A Research Handbook (pp. 31-159).

 New York, NY: The Guildford Press.

Hill, C. E., Thomas, T. B., & D. K. Rardin. (1979). Comparison of

 Rogers, Perls, and Ellis on the Hill counselor verbal response category system. Journal of Counseling Psychology,

26, 198-203.

Open bales.sav in SPSS

|  |
| --- |
| File Name = crscro7.sps |
| CROSSTABS /TABLES=client BY therap /FORMAT= AVALUE NOINDEX BOX LABELS TABLES /STATISTIC=CHISQ CC PHI LAMBDA UC ETA CORR GAMMA D BTAU CTAU KAPPA /CELLS= COUNT . |

 The following ratings are taken from the ratings above that used Bale’s system of rating. The following are those ratings and the various nonparametric as indicated in the syntax file above are computed on the data.

 bales.sav

 Client Therapist

 10 4

 10 5

 7 4

 11 7

 5 6

 14 7

 7 7

 5 5

 11 11

 5 8

**Crosstabs**



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[Chi Square







 The data for the above analysis are nominal data and consequently, only those statistics based on nominal data are appropriate for analysis. Only conditional probability statistics are appropriate.

Canfield rating system.

Each utterance should be rated on all five dimensions. Each rating should be on a 0 to 8 scale.

Dimension # 1. *Positive/Negative emotion*. Rate the degree to which positive or negative emotion is expressed. Positive emotion could include joy, happiness, love, cheerful, enjoy, comfort, relief, satisfaction. While negative emotion could include depression, misery, anger, apprehension, pain, hunger, despair. The rating is from -8 (strong negative emotion) to +8 strong postivie emotion.

Dimension # 2. *Asking for information*. Rate the degree to which the person making the utterance is asking for information.

Dimension # 3. *Giving information*. Rate the degree to which the person is giving information. Also include giving suggestion or direction.

Dimension # 4. *Agreement/Disagreement*. The degree to which the person agrees or disagrees with the previous speaker. The range is from -8 (strong disagreement) to +8 strong agreement.

Dimension # 5. *Positive/Negative relationship(s)*. Identifies positive or negative relationship issues.

0 0 2 0 4 CL: I hadn't thought of it that way./ I don't know if that's exactly it./ I think I'm pretty independent./

0 0 5 -3 0 CO: Well, lets look at that for a minute./ You say you're independent/but when your parents tell you to do all these things, you do them./

-3 4 2 -1 -4 CL: What else can I do?/ What choice do you think I have?/ I'm living there/and the rule is that I should do what they say as long as I live under their roof./ They might kick me out if I didn't./

-4 6 4 0 -2 CO: You know, when I was your age I had a very difficult time leaving home./My father had died and my mother was all alone./ I felt guilty for a long time about leaving her./I wonder if you're feeling some guilt about growing up and leaving them!/

-7 6 0 0 -5 CL: Well, I do feel guilty about leaving but also angry at them for making me feel this way and for treating my brother differently./ What do you think I ought to do resolve this?/

0 0 5 0 2 CO: Maybe it would a good idea to drop out of school for awhile, get a job, and make enough money to move into your own apartment./

-5 0 3 -3 -6 CL: I've thought about that but I feel anxious that I'd never go back to school./ But you know, as I think about it, maybe the reason I have so much trouble about motivation in school is because of these conflicts with my parents./

0 8 0 0 0 CO: What do you mean?/

0 0 3 0 -4 CL: Well I feel like I'm doing everything for them instead of because of I want to do it and if there's always this battle over my future, it's pretty hard for me to figure out what I want./

-3 0 6 0 0 CO: When you said that, your forehead wrinkled up and you began to look tearful./

0 0 0 0 0 CL: (silence = 10 seconds)/

0 4 4 0 -3 CO: We only a have couple of minutes left./ Where would you like to go from here with this problem?/

0 8 0 0 0 CL: Do you think it would be worthwhile to talk to someone again?/

0 8 0 0 0 CO: What do you think?/

-5 0 5 4 6 CL: You've made me think about some things./I'm feeling really confused right now./ I wasn't sure before this about seeing you because I didn't know what to expect from this counseling/but you seem to understand me./ Maybe you can help me figure out some of this mess with my parents and school./

0 4 0 5 4 CO: Yeah./ It sounds like you have trouble figuring out who you are and what you want out of your life, separate from what your parents want./That certainly seems like something appropriate to talk about here in counseling./ I think it would be a good idea for you to continue to see me./

-3 0 4 0 -2 CL: I do feel a bit anxious talking to you because it feels like you can see right through me./

-3 0 0 0 3 CO: I feel somewhat anxious right now too./I usually feel a little bit tense until I get to know a person and decide whether we can work together./I think you did the right thing by coming in at this point in your life./You'll probably feel better after talking about your concerns./

0 5 0 4 4 CL: I hope so./I think I'll go home and think about some of these things./Maybe I'll think about my options about moving out and where I could afford to live./Maybe I'll talk some to my parents about moving out./Does that sound like a good idea to you?/

0 0 5 0 0 CO: Why don't we talk through that at your next session?/We need to

Hill, C. E. (1988). An Overview of the Hill Counselor and Client: Verbal Response Modes Category Systems. In L. S.

Greenburg & W. M. Pinsof (Eds.), The Psychotherapeutic Process: A Research Handbook (pp. 31-159). New York,

NY: The Guildford Press.

Open canrate1.sav in SPSS

|  |
| --- |
| File Name = cancor1.sps |
| CORRELATIONS /VARIABLES=temot task tgive tagrdis trelate cemot cask cgive cagrdis crelate /PRINT=TWOTAIL NOSIG /STATISTICS DESCRIPTIVES /MISSING=PAIRWISE . |

 The ratings of the therapist are the first five numbers of each row and the next five numbers are the ratings of the client. When a correlation is computed between column 1 and column 5 it results in a cross-lagged correlation between the positive/negative emotions therapist and positive/negative emotions of the client. If it were a positive correlation it would indicate that whatever emotion is exhibited by the therapist is followed by the same emotion of the client.

 0 0 5 -3 0 -3 4 2 -1 -4

 -4 6 4 0 -2 -7 6 0 0 -5

 0 0 5 0 2 -5 0 3 -3 -6

 0 8 0 0 0 0 0 3 0 -4

 -3 0 6 0 0 0 0 0 0 0

 0 4 4 0 -3 0 8 0 0 0

 0 8 0 0 0 -5 0 5 4 6

 0 4 0 5 4 -3 0 4 0 -2

 -3 0 0 0 3 0 5 0 4 4

**Correlations**



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Description of a Crosslagged correlation matrix

0 0 2 0 4 0 0 5 -3 0

 -3 4 2 -1 -4 -4 6 4 0 0

 -7 6 0 0 -5 0 0 5 0 2

 -5 0 3 -3 -6 0 8 0 0 0

 0 0 3 0 -4 -3 0 6 0 0

 0 0 0 0 0 0 8 0 0 0

 0 8 0 0 0 -5 0 5 4 6

 -5 0 5 4 6 -3 0 4 0 -2

 -3 0 4 0 -2 0 5 0 4 4

**Correlations**





 This cross lagged correlation is like the above matrix except that in this matrix the therapist is following the clent.

1. Nonparametric Tests Among Groups

The intent of this section is to present nonparametric statistics that tests differences between groups, however, the Spearman Rank Order correlation is included (correlation assesses a relationship not differences).

When using nonparametric statistics one makes no assumptions about the distribution of the data. The underlying distribution or characteristics of the data may be nominal, ordinal, interval or ratio data. Comparable parametric statistics are shown in square brackets.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Number of samples – groups | DV onlyNominal | IV – NominalDV – Nominal | IV – NominalDV – Ordinal | IV – OrdinalDV – Ordinal |
| One Sample | Binomial (d) | ChiSquare |  |  |
| Two related samples  | ChiSquare | ChiSquareMcNemarSign[Correlated t-test] |  | Spearman Rank Order[Pearson r] |
| K related samples | \* |  | FriedmanKendall (R & D)[one-way ANOVA with repeated measures] |  |
| Two independent samples | \* |  | MWU (d)WW (d)Median[t-test for independent samples] |  |
| K independent samples | \* |  | KW (d)[one-way ANOVA] |  |

DV is the abbreviation for the dependent variable and IV is the abbreviation for the independent variable.

Statistics in brackets [] indicate parametric tests that are comparable to the other nonparametric statistics in the same box. For example, the one-way ANOVA with repeated measures is a parametric statistic that is comparable to the nonparametric statistics of Friedman and Kendall.

Binomial -- tests whether a sample is the same as that expected from a binomial distribution.

ChiSquare -- tests the difference between observed and expected frequencies (the expected frequencies can be set for comparison).

Friedman -- compares the ranks of K number of related samples. The output is the mean rank of each variable, valid cases chi square, df and p-value.

KW Kruskal-Wallis -- tests whether K unrelated groups are from the same population. The dependent variable is ordinal (ranked).

Kendall -- tests whether K groups are from the same population.

MWU -- tests whether two groups are drawn from the same population. U is the number of times a score from group 1 precedes a score from group 2.

Sign (Also know as the Wilcoxon test) -- tests the relationship of repeated measures.

WW - Wald-Wolfowitz -- tests whether the distribution is the same for two independent samples (tests runs).

Sample Data 1. The following data is used in some of the examples below:



Open crsleq1.sav in spss.

|  |
| --- |
| File Name = crsmwu1.sps |
| NPAR TESTS /M-W= feelg BY group(1 2) /STATISTICS= DESCRIPTIVES QUARTILES /MISSING ANALYSIS. |

Or generate by using clicks:





**NPar Tests**



**Mann-Whitney Test**





The Mann-Whitney U tests determines whether there is a significant difference between the mean ranks of the two groups. In the data above the two groups are hospitalized clients and non-hospitalized people. The write-up for the above results should contain the following:

 Results of the Mann-Whitney U test indicate that there is a significant difference between the hospitalized and non-hospitalized subjects (*U*=20.00, *z*=-2.30, *p*=.02).

|  |
| --- |
| File name – fri1.sps |
| NPAR TESTS /FRIEDMAN = leisur feelg worth /STATISTICS DESCRIPTIVES QUARTILES /MISSING LISTWISE. |
| Sample Data 2.  |
| LEISUR | FEELG | WORTH | RNKLEIS | RNKFEELG | RNKWORTH |
| 6 | 6 | 6 | 2.00 | 2.00 | 2.00 |
| 6 | 4 | 4 | 3.00 | 1.50 | 1.50 |
| 7 | 0 | 2 | 3.00 | 1.00 | 2.00 |
| 8 | 7 | 8 | 2.50 | 1.00 | 2.50 |
| 6 | 5 | 5 | 3.00 | 1.50 | 1.50 |
| 5 | 6 | 6 | 1.00 | 2.50 | 2.50 |
| 4 | 4 | 4 | 2.00 | 2.00 | 2.00 |
| 8 | 6 | 8 | 2.50 | 1.00 | 2.50 |
| 6 | 7 | 7 | 1.00 | 2.50 | 2.50 |
| 6 | 4 | 5 | 3.00 | 1.00 | 2.00 |
| 4 | 4 | 2 | 2.50 | 2.50 | 1.00 |
| 1 | 1 | 2 | 1.50 | 1.50 | 3.00 |
| 5 | 7 | 6 | 1.00 | 3.00 | 2.00 |
| 0 | 0 | 0 | 2.00 | 2.00 | 2.00 |
| 1 | 2 | 0 | 2.00 | 3.00 | 1.00 |
| 5 | 1 | 1 | 3.00 | 1.50 | 1.50 |
| 3 | 3 | 2 | 2.50 | 2.50 | 1.00 |
| 3 | 2 | 3 | 2.50 | 1.00 | 2.50 |
| 4 | 4 | 3 | 2.50 | 2.50 | 1.00 |
| 1 | 0 | 0 | 3.00 | 1.50 | 1.50 |
| 89 | 73 | 74 | 46 | 37 | 38 |
| 4.45 | 3.65 | 3.70 | 2.28 | 1.85 | 1.88 |

The ranks for the Freidman are by subject. Notice subject number 3. That person obtained a 7 on leisure, a 0 on feelgood and a 2 on worth. The corresponding ranks are rank 3 for leisure, rank 1 feelgood and rank 2 for worth.

Click on Statistics

Click on Nonparametric Tests

Click on Legacy Dialogs

Click on K Related Samples

Select Friedman

Select leisur

Click on right delta for Test Variable List:

Select feelg

Click on right delta for Test Variable List:

Select worth

Click on ‘right delta’ for Test Variable list:

Click on Options

 Select Descriptions

 Select Quartiles

Click on Continue

Click on Paste

Select All

Click on right delta to run

**NPar Tests**

****

**Friedman Test**

****

****

 The Friedman test determines whether there is a significant difference among mean ranks of two or more groups. The groups are Leisure, Feel Good, and Worth. The write-up for the above results should contain the following:

 Results of the Friedman test indicate that there is not a significant difference between Leisure, Feel Good, and Worth. The obtained *X2*=3.31, df=2, was not significant at the .05 level.

Open crsmed1.sps

|  |
| --- |
| File Name = crsmed1.sps |
| NPAR TESTS /MEDIAN= feelg BY group(1 2) /STATISTICS DESCRIPTIVES QUARTILES /MISSING ANALYSIS. |

Sample Data Set 3. Median of feel is 4. If > 4 then assigned High feel good =1. If feel is <= 4 then assigned to Low feel good =2.

|  |  |  |
| --- | --- | --- |
| GROUP | FEELG | GTLTMED |
| 1 | 6 | 1.00 |
| 1 | 4 | 2.00 |
| 1 | 0 | 2.00 |
| 1 | 7 | 1.00 |
| 1 | 5 | 1.00 |
| 1 | 6 | 1.00 |
| 1 | 4 | 2.00 |
| 1 | 6 | 1.00 |
| 1 | 7 | 1.00 |
| 1 | 4 | 2.00 |
| 2 | 4 | 2.00 |
| 2 | 1 | 2.00 |
| 2 | 7 | 1.00 |
| 2 | 0 | 2.00 |
| 2 | 2 | 2.00 |
| 2 | 1 | 2.00 |
| 2 | 3 | 2.00 |
| 2 | 2 | 2.00 |
| 2 | 4 | 2.00 |
| 2 | 0 | 2.00 |

Click on Statistics

Click on Nonparametric Tests

Click on Legacy Dialogs

Click on K Independent Samples

Select Median

Select feelg

Click on right delta for Test Variable List:

Select Group

Click on right delta Grouping Variable

Click on Define Groups

 Enter 1 for Group 1

 Enter 2 for Group 2

Click on Continue

Click on Options

 Select Descriptions

 Select Quartiles

Click on Continue

Click on Paste

Select All

Click on right delta to run

**NPar Tests**



**Median Test**





 The Median test determines whether there is a significant difference the medians two groups. In the data above the two groups are hospitalized clients and non-hospitalized people. The write-up for the above results should contain the following:

 Results of the Median test indicate that there is not a significant difference between the hospitalized and non-hospitalized subjects (*p*=.057).

Open crskw1.sps

|  |
| --- |
| File name = crskw1.sps |
| NPAR TESTS /K-W=feelg BY group(1 2) /STATISTICS DESCRIPTIVES QUARTILES /MISSING ANALYSIS. |

Uses Sample Data Set 1.

Click on Statistics

Click on Nonparametric Tests

Click on Legacy Dialogs

Click on K Independent Samples

Select Kruskal-Wallace H

Select feelg

Click on right delta for Test Variable List:

Select Group

Click on right delta Grouping Variable

Click on Define Groups

 Enter 1 for Group 1

 Enter 2 for Group 2

Click on Continue

Click on Options

 Select Descriptions

 Select Quartiles

Click on Continue

Click on Paste

Select All

Click on right delta to run

**NPar Tests**



**Kruskal-Wallis Test**





 The Kruskal-Wallis test determines whether there is a significant difference among mean ranks of two or more unrelated groups. In the data above the two groups are hospitalized clients and non-hospitalized people. The write-up for the above results should contain the following:

 Results of the Kruskal-Wallis test indicate that there is a significant difference between hospitalized and non-hospitalized subjects. The obtained *X2*=3.31, df=2, was significant at the .05 level.

Spearman Rank Order Correlation (rho)

Open crsleqrho.sav into SPSS

|  |
| --- |
| File = spearman.sps |
| NONPAR CORR /VARIABLES=feelg worth /PRINT=SPEARMAN TWOTAIL NOSIG /MISSING=PAIRWISE . |

Sample Data Set 5.

|  |  |  |  |
| --- | --- | --- | --- |
| FEELG | WORTH | FEELRNK | WORTHRNK |
| 0 | 0 | 2.00 | 2.00 |
| 0 | 0 | 2.00 | 2.00 |
| 2 | 0 | 6.50 | 2.00 |
| 1 | 1 | 4.50 | 4.00 |
| 0 | 2 | 2.00 | 6.50 |
| 1 | 2 | 4.50 | 6.50 |
| 3 | 2 | 8.00 | 6.50 |
| 4 | 2 | 11.00 | 6.50 |
| 2 | 3 | 6.50 | 9.50 |
| 4 | 3 | 11.00 | 9.50 |
| 4 | 4 | 11.00 | 11.50 |
| 4 | 4 | 11.00 | 11.50 |
| 4 | 5 | 11.00 | 13.50 |
| 5 | 5 | 14.00 | 13.50 |
| 6 | 6 | 16.00 | 16.00 |
| 6 | 6 | 16.00 | 16.00 |
| 7 | 6 | 19.00 | 16.00 |
| 7 | 7 | 19.00 | 18.00 |
| 6 | 8 | 16.00 | 19.50 |
| 7 | 8 | 19.00 | 19.50 |

**Nonparametric Correlations**

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