TESTBANK MULTIPLE CHOICE QUESTIONS

To be used in conjunction with Field, A. P. and Miles, J. (2010). *Discovering Statistics Using SAS* London: SAGE. Questions are listed under the chapter they best represent; however, they should not be given to students with the chapter numbers indicated (or else it will make the answers to some questions fairly obvious!). Correct answers are denoted with a *.

This Testbank is designed to *assist* instructors in their assessment of students, but it may not provide *all of* the questions necessary to run a full examination (for e.g. some chapters have more questions than others). Also, Instructors should take full responsibility for the use of this Testbank in their course assessment. It is intended to provide an aid to teaching and assessment not a direct replacement for an examination paper.

Questions for Ch 19 Multilevel Linear Models are not yet included but will be completed shortly.

Ch 1 Why is my evil lecturer forcing me to learn statistics?

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Ch 2 Everything you wanted to know about Statistics

1. The standard deviation is the square root of
    a. the coefficient of determination
    b. sum of squares
    c. variance*
    d. range

2. A frequency distribution in which low scores are most frequent (i.e. bars on the graph are highest on the left hand side) is said to be:
    a. Positively skewed*
    b. Leptokurtic
    c. Platykurtic
    d. Negatively skewed

3. If the scores on a test have a mean of 26 and a standard deviation of 4, what is the z-score for a score of 18?
    a. –2*
    b. 11
    c. 2
    d. –1.41

4. Which of the following is true about a 95% confidence interval of the mean of a given sample:
    a. 95 out of 100 sample means will fall within the limits of the confidence interval.
    b. There is a 95% chance that the population mean will fall within the limits of the confidence interval.*
    c. 95 out of 100 population means will fall within the limits of the confidence interval.
    d. There is a 0.05 probability that the population mean falls within the limits of the confidence interval.

5. What does a significant test statistic tell us?
    a. There is an important effect.
    b. The hull hypothesis is false.
    c. There is an effect in the population of sufficient magnitude to be scientifically interesting.*
    d. All of the above.

6. A type I error is when
    a. We conclude that there is a meaningful effect in the population when in fact there is not.*
    b. We conclude that there is not a meaningful effect in the population when in fact there is.
    c. We conclude that the test statistic is significant when in fact it is not.
    d. The data we have typed into SAS is different to the data collected.

7. If we calculated an effect size and found it was $r = .42$ which expression would best describe the size of effect.
    a. small
    b. small-to-medium
    c. large
    d. medium-to-large*

8. Which of these statements about statistical power is not true:
    a. Power is the ability of a test to detect an effect.
    b. We can use power to determine how big a sample is required to detect an effect of a certain size.
    c. Power is linked to the probability of making a type I error.
    d. All of the above are true.*

9. What is a significance level?

    a. The level at which statistics finally become meaningful to a stein

    b. The impact that reporting statistics incorrectly could have

    c. A pre-set level of probability that the results are correct

    d. A pre-set level of probability at which it will be accepted that results are due to chance or not. *

10. What is the conventional level of probability that is often accepted when conducting statistical tests?

    a. 0.1

    b. 0.05 *

    c. 0.5

    d. 0.001

11. A null hypothesis:

    a. states that the experimental treatment will have an effect

    b. is rarely used in experiments

    c. predicts that the experimental treatment will have no effect *

    d. none of the above

12. Which of the following terms best describes the sentence: 'In a blind-tasting, people will not be able to tell the difference between margarine and butter'

    a. a directional hypothesis

    b. an operational definition

    c. a null hypothesis

    d. a non-directional hypothesis *

13. The aim of experimental research is to:

    a. be a phenomenon

    b. cause a phenomenon

    c. investigate what caused a phenomenon *

    d. to prevent a phenomenon

14. 'Sleep derivation will reduce the ability to perform a complex cognitive task'. State the direction of this hypothesis:

a. Directional *
b. Non-Directional
c. Both
d. Not enough information given

15. In experiments the independent variable is manipulated to determine:

a. effects on the individual participants
b. effect on the dependent variable *
c. effects of certain stimuli
d. relation to other variables

Ch 3. The SAS Environment

1. Which of the following could **not** be represented by columns in the SASTable Viewer:
    a. Levels of repeated measures variables
    b. Items on a questionnaire
    c. Levels of between-group variables*
    d. Total values from different questionnaires.

2. Ordinal level data are characterised by:
    a. data that can be meaningfully arranged by order of magnitude*
    b. equal intervals between each adjacent score
    c. a fixed zero
    d. none of the above

3. What is the advantage of using SAS over calculating statistics by hand?

    a. Quantitative data analysis is so complex today it is essential to use a stats package
    b. It reduces the chance of making errors in your calculations
    c. It equips you with a useful transferable skill
    d. All of the above *

4. How is a variable name different from a variable label?

    a. It is shorter and less detailed
    b. It is longer and more detailed
    c. It is abstract and unspecific
    d. It refers to codes rather than variables *

5. When crosstabulating two variables, it is conventional to:

a. represent the independent variable in rows and the dependent variable in columns. *
b. assign both the dependent and independent variables to columns.
c. represent the dependent variable in rows and the independent variable in columns.
d. assign both the dependent and independent variables to rows.

6. To generate a correlation coefficient between two variables with ordinal data, which set of instructions should you give SAS?

a. PROC CORR DATA=mydata;
b. PROC REG DATA=mydata PEARSON;
c. PROC MEANS DATA=mydata PEARSON;
d. PROC CORR DATA=mydata SPEARMAN;

7. If you are constructing a data file for a repeated measures design with 10 subjects and three conditions, hw many columns and rows will the file have?

a. Ten columns and four rows
b. Four columns and four rows
c. Ten columns and ten rows
d. Four columns and ten rows *

8. Why might a data file have "missing data"?

a. Some of a participant's responses might be missing *
b. There has been a mistake in saving the SAS data file
c. A participant did not take part in the whole study
d. None of the above

9. What might be an appropriate way to deal with missing data?

a. Ignore it
b. Go back to the participant and demand an answer
c. Define missing values using a DATA step *
d. Start the study again taking more care with data recording

10. What is the correct way to record non-numerical values?

a. You can't, SAS only uses numbers

b. Define the variable as "string" *

c. Recode all the values as numbers

d. Define the variable as a date

Ch 4. Exploring Data

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Ch 5. Exploring Assumptions

1. Which of the following are assumptions underlying the use of parametric tests (based on the normal distribution)?
   a. the data should be normally distributed
   b. the samples being tested should have approximately equal variances
   c. your data should be at least interval level
   d. all of the above*

2. Which of the following does a box-whisker plot not display:
   a. The range
   b. The inter-quartile range
   c. The lower quartile
   d. The mean*

3. Which of the following is least affected by outliers
   a. The range
   b. The mean
   c. The median*
   d. The standard deviation

4. I collected some data about how much buyers of my book liked it (on a scale of 1 = it's utter rubbish) to 10 (I never read anything else). I ended up with a sample of 15467 people. When I looked at the distribution, I found a skew of 1.23 (*SE* = .65). The mean rating was 4.78. What is the z-score for the skew of my data?
    a. 1.89*
    b. 0.53
    c. -3.92
    d. 3.36

5. Which of the following would be the best way to decide whether the skew in the example above is problematic?
    a. See if the z-score is bigger than 1.96 or smaller than -1.96
    b. See if the skew is significant at $p < .05$.
    c. Use the Kolmogorov-Smirnov test.
    d. None of the above because of the large sample size.*

6. Which of the following is not a transformation that can be used to correct skewed data?
    a. Log transformation
    b. Tangent transformation*
    c. Square root transformation
    d. Reciprocal transformation

7. The Kolmogorov-Smirnov test can be used to test:
    a. Whether data are normally-distributed.*
    b. Whether group variances are equal.
    c. Whether scores are measured at the interval level.
    d. Whether group means differ.

8. The assumption of homogeneity of variance is met when:
    a. The variance in one group is twice as big as that of a different group.
    b. Variances in different groups are approximately equal.*
    c. The variance across groups is proportional to the means of those groups.
    d. The variance is the same as the inter-quartile range.

9. If a Kolmogorov-Smirnov test is conducted and the result is significant, what does this mean for the data sample?
    a. The data sample is normally distributed
    b. The comparison used in the test is not valid

c. The data sample is not normally distributed *
d. The test is wrong

10. If a distribution is multimodal, what does this mean?

a. It will not be a normal distribution *
b. The data has been entered incorrectly
c. It will be a normal distribution
d. It will have to be checked with a Levene's test

11. What is an outlier?

a. A set of data outside the data file
b. A single score that is very different form the others *
c. A score derived from a participant who has lied
d. A variable that cannot be quantified

12. Why are z-scores used to check for outliers?

a. They standardise scores for a known mean and standard deviation, allowing comparison *
b. They allow you to allocate letters for missing values
c. A z-score *is* an outlier
d. They standardise scores in order to convert them to values closer to the mean

13. What does independence of data mean?

a. That we must never collect two set so f data from one person
b. That independent researchers must collect the data
c. That scores from one participant are free from influences from other participant
d. That scores in one condition are free from influences from other conditions *

14. Which of the followings NOT a property of a variance ratio?

a. It can be used to demonstrate homogeneity of variances
b. It is one variance divided by another
c. It is one variance multiplied by another*
d. It can show the effect of a treatment on several groups

Ch. 6 Correlation

1. The covariance is
    a. An unstandardized version of the correlation coefficient.
    b. A measure of the strength of relationship between two variables.
    c. Dependent on the units of measurement of the variables.
    d. All of the above.*

2. A scatterplot shows
    a. The frequency with which values appear in the data.
    b. The average value of groups of data.
    c. Scores on one variable plotted against scores on a second variable.*
    d. The proportion of data falling into different categories.

3. Which of the following statement about Pearson's correlation coefficient is not true?
    a. It can be used as an effect size measure
    b. It varies between -1 and +1
    c. It cannot be used with binary variables (those taking on a value of 0 or 1).*
    d. It can be used appropriately on ranked data.

4. The correlation between two variables A and B is .12 with a significance of $p < .01$, what can we concluded?
    a. That there is a substantial relationship between A and B.
    b. That there is a small relationship between A and B.*
    c. That variable A causes variable B.
    d. All of the above.

5. How much variance has been explained by a correlation of .9?
    a. 81%*
    b. 18%
    c. 9%
    d. None of the above

6. When interpreting a correlation coefficient, it is important to look at:
    a. The significance of the correlation coefficient.
    b. The magnitude of the correlation coefficient.

c. The +/ - sign of the correlation coefficient.

d. All of the above.*

7. The relationship between two variables controlling for the effect that a third variable has on *one* of those variables can be expressed using a:

   a. Semi-partial correlation.*

   b. Bivariate correlation.

   c. Point-biserial correlation.

   d. Partial correlation.

8. 20 people took part in study in which they completed two questionnaires: one that measured musical ability and one that measured their mathematical aptitude, the two sets of scores were then analysed to determine if the two skills were related. Which research design was used in the study?

   a. an observational study

   b. a case study

   c. a correlational study*

   d. an experiment

9. If there were a perfect positive correlation between two interval/ratio variables, the Pearson's *r* test would give a correlation coefficient of:

   a. - 0.33.

   b. +1.*

   c. + 0.88.

   d. - 1.

10. What is the name of the test that is used to assess the relationship between two ordinal variables?

    a. Spearman's *rho**

    b. Phi

    c. Cramer's *V*

    d. Chi Square

11. What is meant by a 'spurious' relationship between two variables?

    a. One that is so illogical it cannot possibly be true

    b. An apparent relationship that is so curious it demands further attention

c. A relationship that appears to be true because each variable is related to a third one*

d. One that produces a perfect negative correlation on a scatter diagram

12. A researcher conducts some research in which they identify a significant positive correlation (r =0.42) between the number of children a person has and their life satisfaction. Which of the following is it **inappropriate** to conclude from this research?

a. That having children makes people more satisfied with their life.

b. That someone who has children is likely to be more happy than someone who doesn't. *

c. That the consequences of having children are unclear.

d. That it is possible to predict someone's life happiness partly on the basis of the number of children they have.

13. One of the factors that affects the reliability of findings from studies using correlations is:

a. the number of variables being investigated*

b. the type of relationship that is found

c. the level of significance set at the start of the study

d. the number of people who take part

14. Correlational studies allow the researcher to:

a. test for differences between two variables

b. predict the effect of one variable upon another

c. make causal inferences about the relationship between two variables

d. identify the relationship between two variables*

15. A positive correlation shows that:

a. two variables are unrelated

b. as one score increases so does the other*

c. as one score increases so the other decreases

d. both a and b

Ch. 7 Regression

1. R^2 is

a. The percentage of variance in the predictor accounted for by the outcome variable.

b. The proportion of variance in the outcome accounted for by the predictor variable or variables.*

c. The proportion of variance in the predictor accounted for by the outcome variable.

d. The percentage of variance in the outcome accounted for by the predictor variable or variables.

2. Which of the following statements about the *t*-statistic in regression is **not** true?

a. The *t*-statistic tests whether the regression coefficient, *b*, is equal to 0.

b. The *t*-statistic provides some idea of how well a predictor predicts the outcome variable.

c. The *t*-statistic can be used to see whether a predictor variable makes a statistically significant contribution to the regression model.

d. The *t*-statistic is equal to the regression coefficient divided by its standard deviation.*

3. Which of the following statements about the *F*-ratio is true:

a. The *F*-ratio is the ratio of variance explained by the model to the error in the model.*

b. The *F*-ratio is the ratio of variance explained by the model to the total variance in the outcome variable.

c. The *F*-ratio is the ratio of error variance to the total variance.

d. The *F*-ratio is the proportion of variance explained by the regression model.

4. Which of the following statements about outliers is not true?

a. Outliers are values very different from the rest of the data.

b. Outliers bias the mean.

c. Outliers bias regression parameters.

d. Outliers are influential cases.*

5. What is multicollinearity?

a. When predictor variables correlate very highly with each other.*

b. When predictor variables have a linear relationship with the outcome variable.

c. When predictor variables are correlated with variables not in the regression model.

d. When predictor variables are independent.

6. Which of the following is **not** a reason why multicollinearity a problem in regression?

a. It limits the size of *R*.

b. It makes it difficult to assess the importance of individual predictors.

c. It leads to unstable regression coefficients.

d. It creates heteroscedasticity in the data.*

7. Which of these statements is **not** true?

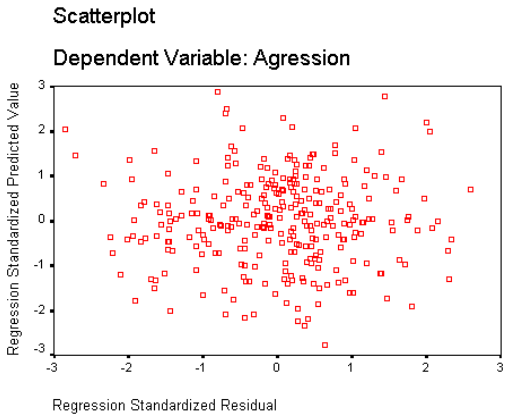
a. If the average variance inflation factor is greater than 1 then the regression model might be biased.

b. Tolerance values above 0.2 may indicate multicollinearity in the data.*

c. Multicollinearity in the data is shown by a VIF (variance inflation factor) greater than 10.

d. The tolerance is 1 divided by the VIF (variance inflation factor).

8. The following graph shows:



a. Heterscedasticity.

b. Non-linearity.

c. Heteroscedasticity and non-linearity.

d. Regression assumptions that have been met.*

9. A researcher had a categorical variable that they wanted to include as a predictor in a regression equation. The researcher was trying to predict the success of a back pain intervention, and the categorical variable was the duration of the back pain prior to treatment with 4 categories: less than 6 months, 6-12 months, 1-2 years, more than 2 years. They needed to code these variables into dummy variables for the regression using less than 6 months as their control category. Which of the following represents the correct coding scheme?

a. *

	Duration of Pain	Dummy 1 (Under 6 Months vs 6-12 Months)	Dummy 2 (Under 6 Months vs 1-2 Years)	Dummy 3 (Under 6 Months vs Over 2 Years)
	Under 6 Months	0	0	0
	6-12 Months	1	0	0
	1-2 Years	0	1	0
	More Than 2 Years	0	0	1

b.

	Duration of Pain	Dummy 1 (Under 6 Months vs 6-12 Months)	Dummy 2 (Under 6 Months vs 1-2 Years)	Dummy 3 (Under 6 Months vs Over 2 Years)
	Under 6 Months	1	1	1
	6-12 Months	1	0	0
	1-2 Years	0	1	0
	More Than 2 Years	0	0	1

c.

	Duration of Pain	Dummy 1 (Under 6 Months vs 6-12 Months)	Dummy 2 (Under 6 Months vs 1-2 Years)	Dummy 3 (Under 6 Months vs Over 2 Years)
	Under 6 Months	0	0	0
	6-12 Months	0	1	1
	1-2 Years	1	0	1
	More Than 2 Years	1	1	0

d.

	Duration of Pain	Dummy 1 (Under 6 Months vs 6-12 Months)	Dummy 2 (Under 6 Months vs 1-2 Years)	Dummy 3 (Under 6 Months vs Over 2 Years)
	Under 6 Months	1	1	1
	6-12 Months	0	1	1
	1-2 Years	1	0	1
	More Than 2 Years	1	1	0

12. The difficulty with using one regression equation to predict values in a different set of data is called

    b. Shrinkage *
    c. Contraction
    d. Reduction
    e. Washing

13. A way of representing discrete variables in multiple regression is by constructing

    a. Stupid variables
    b. Dummy variables*
    c. Imitation variables
    d. Faking variables

Ch. 8 Logistic Regression

1. Logistic regression is used when you want to
    a. Predict a continuous variable from dichotomous ones.
    b. Predict a dichotomous variable from continuous or dichotomous variables.*
    c. Predict any categorical variable from other categorical variables.
    d. Predict a continuous variable from dichotomous or continuous variables.

2. Which of the following statements is not true about the Wald statistic?
    a. The Wald statistic assesses the individual contribution of a predictor to a logistic regression model.
    b. The Wald statistic tends to be biased when the regression coefficient is large.
    c. If the Wald statistic is equivalent to the *t*-statistic in multiple regression?
    d. The Wald statistic has a *t*-distribution.*

3. A researcher was interested in predicting whether a person would attempt to commit suicide (score = 1) or not (score = 0) from their depression scores. They found that the value of exp *b* was 2.56. How should this value be interpreted?
    a. If two people have depression scores that differ by 1 unit, then the odds of the person with the higher score attempting suicide are is 2.56 *higher* than for the other person. *
    b. 2.56 times more people who attempted suicide scored highly on depression.
    c. If two people have depression scores that differ by 1 unit, then the odds of the person with the higher score attempting suicide are is 2.56 *lower* than for the other person.
    d. Suicide rates are 2.56 times as high in depressed people.

4. The odds of an event are:
    a. The ratio of the probability of an event not happening to the probability of the event happening.
    b. The ratio of the probability of an event happening to the probability of the event not happening.*
    c. The probability of an event occurring.
    d. None of the above.

5. What does logistic regression NOT do?

a. predicts a dependent variable on the basis of several independent variables

b. determines the variance in the dependent variable explained by the independent variables

c. ranks the relative importance of independent variables *

d. assesses the impact of covariate control variables.

6. Logistic regression

a. Estimates values in the outcome variable

b. Estimates a probability that the outcome variable assumes a certain value *

c. Estimates probabilities in the outcome variable

d. Estimates the profanities that the predictor variables assume certain values

7. What is an alternative to logistic regression when the dependent variable has more than two classes?

a. Binomial regression

b. Logit regression

c. Legit regression

d. Multinomial regression *

8. Large log-likelihood values do NOT show

a. The extent of the relationship between independent and dependent variables

b. That there are a large number of unexplained observations in the data

c. That there is a large measure of deviance

d. That the model is a good fit *

9. In logistic regression, the dependent variable is called a *logit*, which is

a. the natural log of the odds*

b. the rolling mean

c. a log rolling

d. a mean log

10. Which of the following is NOT a research question which could be investigated with logistic regression?

a. Prediction of group membership

b. Strength of association between criterion and predictors

c. Differences between groups *

d. Interaction between predictors

11. Very high standard errors in parameter estimates in logistic regression suggest there is

a. Shrinkage

b. Multicollinearity *

c. An outlier

d. A dummy variable

12. With conventional coding in logistic regression of 0 and 1, if there are 100 cases and 40 are coded as 1, what is the mean of the variable?

a. 40

b. 0.4 *

c. 2.5

d. 25

13. In the above example, the mean is also equal to

a. The mode

b. The probability of randomly drawing a 1*

c. The median

d. The probability of drawing a 0

14. The odds ratio is

a. The natural log to the bth power, where b is the unstandardised parameter estimate *

b. The natural log to the bth power, where b is the standardised parameter estimate

c. The base 10 log to the bth power where b is the unstandardised parameter estimate

d. The base 10 log to the bth power where b is the standardised parameter estimate

Ch. 9 Comparing the two means

1. A researcher was interested in stress levels of lecturers during lecturers. She took the same group of 8 lecturers and measured their anxiety (out of 15) during a normal lecture and again in a lecture in which she had paid students to be disruptive and misbehave. Based on the SAS output how would you interpret these results?

Difference: Misbehaved – Normal Lecture

N	Mean	Std Dev	Std Err	Minimum	Maximum
8	6.2500	4.8033	1.6982	1.0000	12.0000

Mean	95% CL Mean		Std Dev	95% CL Std Dev	
6.2500	2.2344	10.2656	4.8033	2.2344	10.2656

6.

7.

DF	t Value	Pr > |t|
7	3.680	0.008

a. Anxiety levels were significantly lower in lectures in which students misbehaved.

b. There were no significant differences between anxiety levels in normal lectures and in those in which students misbehaved.

c. Anxiety levels were significantly higher in lectures in which students misbehaved.*

d. We can't tell any of the above from the output given.

2. A psychologist was interested in whether there was a gender difference in the use of email. She hypothesised that because women are generally better communicators than men, they would spend longer using email than their male counterparts. To test this hypothesis, the researcher sat by the email computers in her research methods laboratory and when someone started using email, she noted whether they were male or female and then timed how long they spent using email (in minutes). What should she report?

sex	N	Mean	Std Dev	Std Err	Minimum	Maximum
Male	8	5.0000	4.5039	1.59239	1	17
Female	8	32.0000	40.0464	14.15684	13	69
Diff (1-2)		-27.000	99.7360	14.24781		

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	14	-1.895	0.079
Satterthwaite	Unequal	7.1777	-1.895	0.099

a. Females spent significantly longer using email than males,

$t(7.18) = -1.90$, $p < .05$.*

b. Females spent significantly longer using email than males,

$t(14) = -1.90$, $p < .05$.

c. Females and males did not significantly differ in the time spent using email, $t(7.18) = -1.88$, *ns*.

d. Females and males did not significantly differ in the time spent using email, $t(14) = -1.88$, *ns*.

3. A researcher was interested in the effects of emotion-evoking music on exam performance. Before their SAS exam, a lecturer took one group of students to a room in which calming music was being played. A different group of students were taken to another room in which the 'death march' was being played. The students then did the exam and their marks were noted. The SAS output is below. The experimenter made no predictions about which form of support would produce the best exam performance. What should he report?

sex	N	Mean	Std Dev	Std Err	Minimum	Maximum
F	20	57.8000	15.2129	3.4017	30.7284	71.3358
M	20	65.1500	5.0396	1.1269	59.1341	69.1606
Diff (1-2)		-7.3500	11.3320	3.5835		

sex	Method	Mean	95% CL Mean		Std Dev	95% CL Std Dev	
F		57.8000	50.6801	64.9199	15.2129	11.5693	22.2195
M		65.1500	62.7914	67.5086	5.0396	3.8326	7.3607
Diff (1-2)	**Pooled**	-7.3500	-14.6044	-0.0956	11.3320	9.2611	14.6045
Diff (1-2)	**Satterthwaite**	-7.3500	-14.7609	0.0609			

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	38	-2.05	0.0472
Satterthwaite	Unequal	23.121	-2.05	0.0518

Equality of Variances				
Method	**Num DF**	**Den DF**	**F Value**	**Pr > F**
Folded F	19	19	9.11	<.0001

a. Students receiving positive music before the exam did significantly better than those receiving negative music, $t(38) = 2.05$, $p < .05$.

b. Marks for students receiving positive music before the exam did not significantly differ from students receiving negative music, $t(38) = 2.05$, *ns*.

c. Students receiving positive music before the exam did significantly better than those receiving negative music, $t(23.12) = 2.05$, $p < .05$, 1-tailed.

d. Marks for students receiving positive music before the exam did not significantly differ from students receiving negative music, $t(23.12) = 2.05$, *ns*.*

4. What does the error bar on an error bar chart represent?

a. The confidence interval round the mean.

b. The standard error of the mean.

c. The standard deviation of the mean.

d. It can represent any of a, b or c.*

5. The *t*-test tests for:

a. Differences between means.

b. Whether a correlation is significant.

c. Whether a regression coefficient is equal to zero.

d. All of the above.*

6. An independent *t*-test is used to test for:

a. Differences between means of groups containing different people when the data are normally distributed, have equal variances and data are at least interval.*

b. Differences between means of groups containing different people when the data are not normally distributed or have unequal variances.

c. Differences between means of groups containing the same people when the data are normally distributed, have equal variances and data are at least interval.

d. Differences between means of groups containing different people when the data are not normally distributed or have unequal variances.

7. An dependent t-test is used to test for:

a. Differences between means of groups containing different people when the data are normally distributed, have equal variances and data are at least interval.

b. Differences between means of groups containing different people when the data are not normally distributed or have unequal variances.

c. Differences between means of groups containing the same people when the data are normally distributed, have equal variances and data are at least interval.*

d. Differences between means of groups containing different people when the data are not normally distributed or have unequal variances.

8. The t-test can be characterized as a regression (linear) model if:

a. The outcome variable is categorical.

b. The groups have equal sample sizes.

c. The experimental groups are represented by a binary variable (i.e. coded 0 and 1).*

d. A t-test is always different from regression.

9. Participants take a simulated driving test twice, in one condition they have no alcohol, in the other they have enough alcohol to take them over the legal limit. Is this design:

a. Repeated measures *

b. Related measures

c. Between subjects

d. Independent measures

10. In the above study, which statement is true?

a. The type of alcohol could be a confounding variable

b. It is appropriate to analyse the results using a paired sample *t*-test *

c. The experiment has two dependent variables

d. The experiment has two independent variables

11. Which of the following is an Independent Measures design?

a. all participants perform in all conditions

b. each participant is tested twice, once in each condition

c. different participants perform in each condition*

d. none of the above

12. A Repeated Measures design would be appropriate for which of the following situations?

a. a researcher would like to study the effect of alcohol on reaction time *

b. a researcher would like to compare individuals from at least two populations

c. the effect of a new treatment is studied in a small group of individuals with a rare condition

d. a and b

Ch. 10 Comparing Several Means

1. Based on the ANOVA table below calculate the value of F.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	540.225000	791.429	?????	0.0472
Error	45	4879.767997	?????		
Corrected Total	47	5419.992997			

a. 0.74

b. 16.62.*

c. 4.71.

d. 2.71.

2. A researcher wanted to see the effects of different learning strategies. A control group simply read the book Discovering statistics (book), a second group read the book and completed the 'end of chapter exercises' (book & exercises), and a third group read the book, did the end of chapter examples and also completed the web materials (all activities). The researcher predicted that all activities and book and exercises would perform better than the book group on a subsequent test, but the

book and exercises would be worse than the all activities. Which coding scheme would test these hypotheses in a set of planned comparisons?

	Contrast	Book	Book & Exercises	All Activities
1	Contrast 1	0	1	1
2	Contrast 2	0	1	-1

	Contrast	Book	Book & Exercises	All Activities
1	Contrast 1	-2	1	1
2	Contrast 2	0	1	-1

*

	Contrast	Book	Book & Exercises	All Activities
1	Contrast 1	2	1	1
2	Contrast 2	0	1	1

Case Summaries[a]

	Contrast	Book	Book & Exercises	All Activities
1	Contrast 1	2	-1	-1
2	Contrast 2	0	-1	-1

a. Limited to first 100 cases.

3. A Bonferroni correction is when.
   a. You apply a criterion for significance based on the usual criterion for significance (0.05) divided by the number of tests performed.*
   b. You divide the F-ratio by the number of tests performed.
   c. The degrees of freedom are corrected to make the F-ratio less significant.
   d. The error in the model is adjusted for the number of tests performed.

4. Levene's test tests whether:
   a. Data are normally-distributed.
   b. The variances in different groups are equal.*
   c. The assumption of sphericity has been met.
   d. Group means differ.

5. A psychologist was looking at the effects of an intervention on depression levels. Three groups were used: waiting list control, treatment and post treatment (a group who had had the treatment 6 months before). The change in depression levels over the time of the treatment were recorded (although bear in mind only the treatment group actually got any treatment during this time). The SAS output is below; based on this output what should the researcher conclude:

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	529.437	264.719	5.110	0.0100
Error	45	2331.135	51.803		
Corrected Total	47	2860.572			

Levene's Test for Homogeneity of BDIDIF Variance ANOVA of Squared Deviations from Group Means					
Source	**DF**	**Sum of Squares**	**Mean Square**	**F Value**	**Pr > F**
sex	1	538	538	4.246	0.0201
Error	38	4814	126.7		

Welch's ANOVA for BDIDIF			
Source	**DF**	**F Value**	**Pr > F**
sex	1.0000	4.21	0.0518
Error	23.1205		

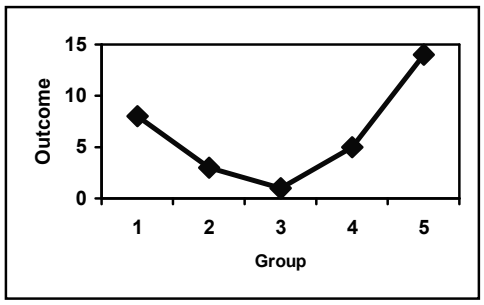
a. The treatment groups did not have a significant effect on the change in depression levels, F(2, 26.44) = 4.25.

b. The treatment groups had a significantly effect on the change in depression levels, F(2, 35.10) = 4.25.*

c. The treatment groups had a significantly effect on the change in depression levels, F(2, 45) = 5.11.

d. The treatment groups did not have a significant effect on the change in depression levels, F(2, 45) = 5.11.

6. What kind of trend does the following graph show?



a. Linear.

b. Quadratic.*

c. Cubic.

d. Quartic.

7. If the critical region for a test of hypothesis is F > 9.4877 and the computed value of F from the data is 0.86 then which of the following is correct

   a. The null hypothesis should be rejected.

   b. The alternate hypothesis is two-tailed.

   c. The significance level is given by the area to the right of 9.48773 under the appropriate F distribution. *

   d. The significance level is given by the area to the left of 9.48773 under the appropriate F distribution.

8. In a simple analysis of variance problem, which of the following is an estimate of the variance of individual measurements (after the various effects have been accounted for)?

   a. MS(between)

   b. MS(within)*

   c. MS(total)

   d. none of the above

9. What is the definition of Mean Square?

   a. A sum of squares divided by its degrees of freedom. *

   b. The square root of the mean

   c. The square of the mean

   d. A table of means with four cells

10. The total variation in response, assuming no bias, is due to error (unexplained variation) plus differences due to treatments (known variation). If known variation is large compared to unknown variation, which of the following conclusions can be drawn?
    a. There is no difference in response due to treatments.
    b. There is a difference in response due to treatments. *
    c. The treatments are not comparable.
    d. The cause of the response is due to something other than treatments.

Consider this table:

Analysis of Variance

Source	SS	Df	MS	F
Between samples	722.7	4	180.68	15.3
Within samples	473.3	40	11.84	
Total	1196.0	44		

11. If all samples sizes are equal then the study used:
    a. 4 samples of size 10.
    b. 5 samples of size 10.
    c. 4 samples of size 9.
    d. 5 samples of size 9 *

12. In the above table what is the likely interpretation?
    a. The Alternate hypothesis is rejected
    b. The Null hypothesis is rejected *
    c. Not enough information
    d. The null hypothesis is accepted

13. An experiment was conducted as a one-way factorial design with K sample means, each based on n scores. What is the number of degrees of freedom for the between mean squares?
    a. n - 1
    b. K – 1 *
    c. n - K

d. (n - 1)(K - 1)

Ch. 11 Analysis of Covariance

1. What assumption does ANCOVA have that ANOVA does not?
    a. Homogeneity of variance.
    b. Homogeneity of regression slopes*.
    c. Homoscedasticity.
    d. Homogeneity of sample size.

2. A music teacher had noticed that some students went to pieces during exams. He wanted to test whether this performance anxiety was different for people playing different instruments. He took groups of guitarists, drummers and pianists (variable = 'Instru') and measured their anxiety (Variable = 'Anxiety') during the exam. He also noted the type of exam they were performing (in the UK, musical instrument exams are known as 'grades' and range from 1 to 8). He wanted to see whether the type of instrument played affected performance anxiety when controlling for the grade of the exam, what analysis should he use?

    a. Analysis of Covariance*.
    b. Independent Analysis of Variance.
    c. Repeated Measures Analysis of Variance.
    d. Mixed Analysis of Variance.

3. Here is part of the SAS output for the example in the previous question. Which of the following statements best reflects what the effect of 'INSTRU' in the table tells us?

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	8151.482	2717.161	16.317	<0.0001
Error	56	9325.228	166.522		
Corrected Total	59	17476.710			

Source	DF	Type III SS	Mean Square	F Value	Pr > F
grade	1	907.833	907.833	5.452	0.0234
instru	2	6351.708	3175.854	19.072	<0.001

a. The type of Instrument played in the exam had a significant effect on the level of anxiety experienced.

b. The type of Instrument played in the exam did not have a significant effect on the level of anxiety experienced.

c. The type of Instrument played in the exam had a significant effect on the level of anxiety experienced even after the effect of the grade of the exam had been accounted for.*

d. The type of Instrument played in the exam did not have a significant effect on the level of anxiety experienced even after the effect of the grade of the exam had been accounted for.

4. Using the SAS output in the previous question, which of the following statements best reflects what the effect of ''GRADE' in the table tells us?

a. The grade of exam had a significant relationship with the level of anxiety experienced.*

b. The grade of exam did not have a significant relationship with the level of anxiety experienced.

c. The type of instrument played had a significant relationship with the grade of exam that was being taken.

d. The type of instrument played did not have a significant relationship with the grade of exam that was being taken.

5. A health psychologist was interested in the effects of smoking on the suppression of the immune system. Three groups of adults were exposed (in a highly ethical way) to either a cold virus, a flu virus or were left freezing wet in the outside in the middle of winter to catch pneumonia (no more than smokers deserve!). The severity of the disease was then measured as a percentage (0% = not contracted, 100% = contracted to a very severe degree). The psychologist also measured the number of cigarettes that each person smoked per day. The psychologist was interested in the differences in the severity of the three illnesses and the impact of cigarette usage. What technique should be used to analyse these data?

    a. Two-Way Repeated Measures ANOVA.
    b. Two-Way Independent ANOVA.
    c. Two-Way Mixed ANOVA.
    d. One-Way Analysis of Covariance.*

8. Under what circumstances would you NOT consider using analysis of covariance?

    a. You need to try to control for all extraneous variables on which the groups may differ using
    b. You have identified variables that have not been controlled for
    c. You have controlled for all the variables possible *
    d. You need to reduce the unexplained variance.

9. In an experiment to study the effectiveness of 3 different teaching programmes on children's' achievement in mathematics, what might NOT be an appropriate covariate?

    a. IQ
    b. Mathematical aptitude
    c. Age
    d. Height*

10. In an ancova with one covariate and one independent variable, what null hypothesis is NOT tested

    a. The slopes are equal.
    b. the intercepts for each line are equal.
    c. The group means are equal
    d. the slopes are all equal to 1. *

11. Adjusted group means are:

    a. Means across all groups when the covariate has been accounted for*
    b. Means across the covariate
    c. Means across the groups that are significantly different
    d. All the means added together

12. To "partial out" means to:

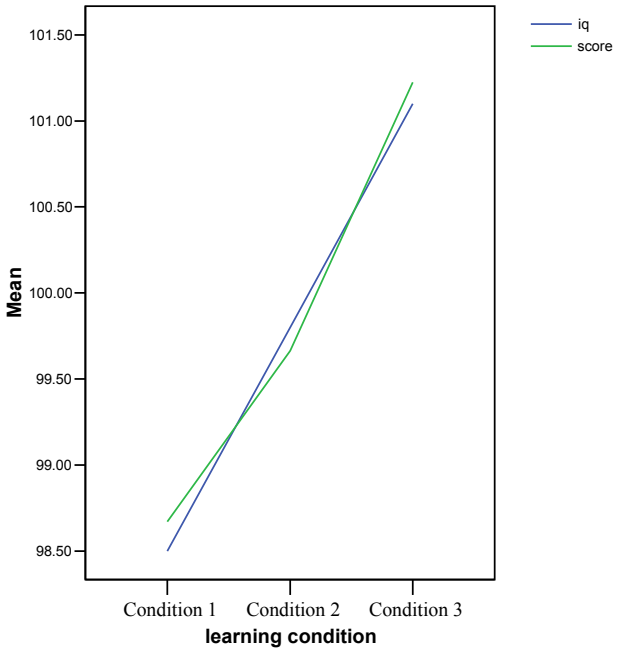
    a. Examine the model without covariates
    b. control for the effect of a covariate*
    c. partition the covariate effects
    d. partition the variance

13. What is an alternative way to model the design of an Ancova?

    a. Linear multiple Regression with the independent variables reduced to dummy variables*

    a. Linear multiple Regression with all the dependent variables and the covariate standardised
    b. Logistic Regression with the independent variables reduced to binary variables
    c. Logistic Regression with all the dependent variables and the covariate reduced to binary variables

Consider the graph



This is the graph of the results of an experiment learning condition as the independent variable and IQ as the covariate.

14. What does the graph indicate?
    a) Although the IV has had an effect on the DV, the covariate is the more likely explanation of effect *
    b) The learning condition has altered IQ
    c) IQ has altered learning condition
    d) Not enough information

Ch. 12 Factorial ANOVA

1. How many dependent variables does a two-way ANOVA have?

a. One*

e. Two

f. Three.

g. Four.

2. An experiment was done to look at the positive arousing effects of imagery on different people. A sample of statistics lecturers was compared against a group of students. Both groups received presentations of positive images (e.g. cats and bunnies), neutral images (e.g. duvets and lightbulbs), and negative images (e.g. corpses and vivisection photographs). Positive arousal was measured physiologically (high values indicate positive arousal) both before and after each batch of images. The order in which participants saw the batches of positive, neutral and negative images was randomised to avoid order effects. It was hypothesised that positive images would increase positive arousal, negative images would reduce positive arousal and that neutral images would have no effect. Differences between the subject groups (lecturers and students) were not expected. What technique should be used to analyse these data?

   a. Two-Way Mixed ANOVA.

   b. Three-Way Repeated Measures ANOVA.

   c. Two-Way Mixed Analysis of Covariance.

   d. Three-way Mixed ANOVA.*

3. In a factorial design, with two factors, if the effect of one factor appears to depend on the levels of the second facto, this is called

   a. A main effect

   b. An interaction effect *

   c. A factorial effect

   d. An error

4. Which of the following is NOT a question answered by two-way anovas?

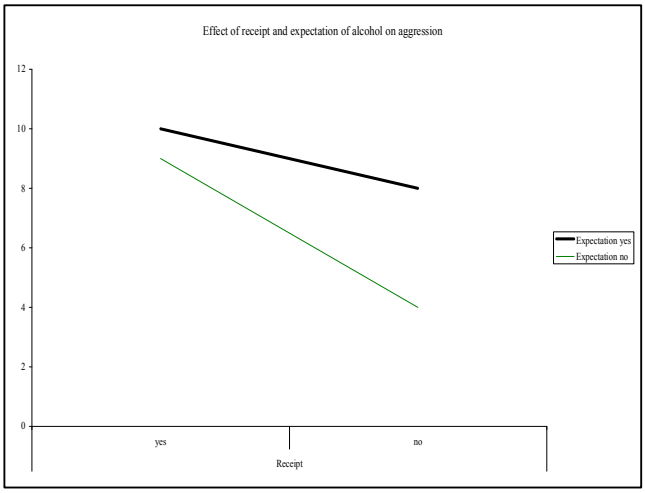
   a. Does one of other of the factor systematically affect the results?

   b. Are the mean responses the same across all levels of a factor?

   c. Do the two factors interact?

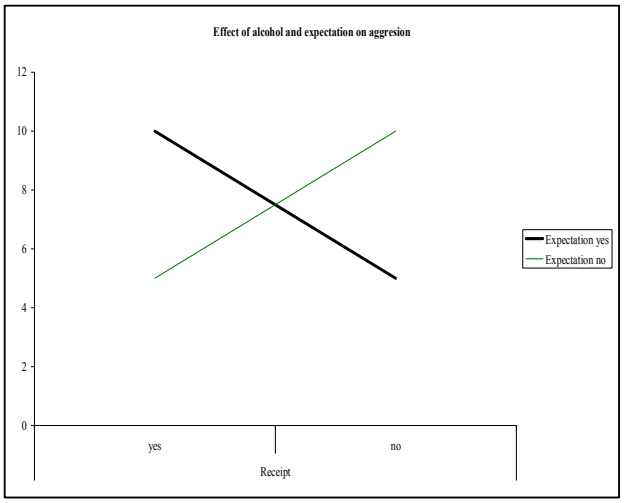
   d. Does one level effect the DV significantly more than the others? *

5. Consider this graph. What is shown in the graph?



a. There is an interaction and no main effects
b. There is one main effect and no interaction
c. There are two main effects and no interaction
d. There is an interaction and two main effects *

6. Consider this graph. What is shown in the graph?



a. There is an interaction and no main effects *
b. There is one main effect and no interaction
c. There are two main effects and no interaction
d. There is an interaction and two main effects

7. If a study has employed a two-way mixed anova, what does this mean?

a. There were men and women participants in the study
b. There were two factors in the study each with different numbers of levels
c. There was a repeated measure factor and an independent measures factor in the study*
d. The researchers couldn't make up their minds about how to do the study

8. Breaking down a total variance is referred to as:

a. Parting
b. Partitioning*
c. Partition walls
d. Piecing

An experiment was performed in which participants were given lists to learn in either quiet or noisy environments. On later recall either congruous or non-congruous cues for recall were given and recall was either in the same or different context of learning.

9. What design is this experiment?

a. Two-factorial fully independent measures *
b. Two-factorial fully repeated measures
c. Two-factorial one independent and one repeated measures factors
d. Three-factorial

10. Consider the table below which displays data from the experiment. What value should appear where X appears?

Dependent Variable: number correct

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	4738.018	1579.333	55.854	<0.0001
Error	36	1017.925	X		
Corrected Total	40	48560.250			

Source	DF	Type III SS	Mean Square	F Value	Pr > F
context	1	316.406	316.406	Y	.002
cues	1	4378.556	4378.556	154.852	.000
context * cues	1	43.056	43.056	1.523	.225

a. 28.276 *
a. 1017.925
b. 1
c. Not enough information

11. What value should appear where there is a Y?

a. 316.406
b. 11.19*
c. 1
d. Not enough information

12. Consider the table in question 6. What is the outcome of this analysis?

a. There is an interaction and no main effects
b. There is an interaction and one main effect
c. There is no interaction and one main effect
d. There is no interaction and two main effects *

13. What would be the psychological interpretation of the analysis in question 6?

a. Context has an effect on recall
b. Cue-type has an effect on recall
c. Context and cue-type have an effect on recall *
d. Context and cue-type have an effect on recall, but the effect of context depends on cue-type

14. Which procedure is NOT suitable for interpreting interaction effects statistically?

a. Bonferroni corrections of paired t-tests
b. Paired t-tests without correction *
c. Simple effects
d. Tukey's HSD

15. Which of the following is NOT a problem which post-hoc comparisons need to correct for?

a. Family-wise error rates

b. Per comparison error rates

c. Sibling error rates *

d. Experiment-wise error rates

Ch. 13 Repeated- Measures Designs

1. When the assumption of sphericity is violated what action is needed:

a. Correct the model degrees of freedom.

b. Correct the error degrees of freedom.

c. Do both a and b.*

d. Correct the F-ratio.

2. Which of the following statements about the assumption of sphericity is not true?

a. It is tested using Mauchley's test in SAS.

b. Does not apply when a variable has only two levels.

c. Does not apply when multivariate tests are used.

d. It is the assumption that the variances for levels of a repeated measures variable are equal.*

3. A nutritionist conducted an experiment on memory for dreams. She wanted to test whether it really was true that eating cheese before going to bed made you have bad dreams. Over three nights, the nutritionist fed people different foods before bed. On one night they had nothing to eat, a second night they had a big plate of cheese, and the third night they had another dairy product, Milk, before bed. All people were given all foods at some point over the three nights. The nutritionist measured heart rate during dreams as an index of distress. How should these data be analysed?

a. One-way independent ANOVA.

b. One-way repeated measures ANOVA.*

c. Three-way repeated measures ANOVA.

d. Three-way independent ANOVA.

3. A nutritionist conducted an experiment on memory for dreams. She wanted to test whether it really was true that eating cheese before going to bed made you have bad dreams. Over three nights, the nutritionist fed people different foods before bed. On one night they had nothing to eat, a second night they had a big plate of cheese, and the third night they had another dairy product, Milk, before bed. All people were given all foods at some point over the three nights. The nutritionist measured heart rate during dreams as an index of distress. Which statement is the correct way to report these results?

4.

Sphericity Tests				
Variables	**DF**	**Mauchly's Criterion**	**Chi-Square**	**Pr > ChiSq**
Transformed Variates	5	1.153	0.615	0.704
Orthogonal Components	5	0.985	0.548	0.761

						Adj Pr > F	
Source	**DF**	**Type III SS**	**Mean Square**	**F Value**	**Pr > F**	**G - G**	**H - F**
food	2	22.205	11.103	2.265	0.111	0.115	1.111
Error(food)	76	372.462	4.901				

Greenhouse-Geisser Epsilon	0.986
Huynh-Feldt Epsilon	1.000

a. There was a significant effect of food on the distress caused by memories, $F(2, 76) = 2.27$.

b. There was no significant effect of food on the distress caused by memories, $F(2, 76) = 2.27$.*

c. There was a significant effect of food on the distress caused by memories, $F(1.97, 74.90) = 2.27$.

d. There was no significant effect of food on the distress caused by memories, $F(1.97, 74.90) = 2.27$.

5. What is NOT an advantage of repeated measures designs in comparison to independent measures designs?

a. Each participant acts as their own control

b. Researchers can study cross-cultural effects more easily *

c. Researchers can study trends more easily

d. They require fewer participants overall

6. Sphericity is

    a. An assumption that means the data distribution must be round.
    b. The critical value area of the graph is round
    c. A way of rounding up the decimal points
    d. An assumption that means the data in each level should uncorrelated*

7. If there is sphericity in a repeated measures design the outcome could be that

    a. The p value will be too high
    b. The p-value will be too low *
    c. A p-value cannot be computed
    d. The p-value will not be related to the model

8. The Greenhouse-Geisser correction refers to:

    a. Temperature control
    b. A way of dealing with sphericity *
    c. Raising the sample size
    d. Lowering humidity

An experiment was carried out in which participants learned words in several conditions: no learning strategy, a verbal learning strategy, visual one and a verbal-visual one.

9. What considerations would the researchers NOT need to take into account?

    a. Fatigue
    b. Learning effects
    c. Asymmetric transfer
    d. Parametric assumptions *

10. What safeguard could the researchers put in place to overcome the difficulties with repeated measures?

    a. Counterbalancing *
    b. Something to keep the participants awake
    c. Measure an appropriate covariate
    d. Before and after measurements

11. Consider the tables below, the results from the above experiment. What do they indicate?

    a. There is too much sphericity in the model

    b. There are too many errors in the model

    c. The null hypothesis can be rejected*

    d. The null hypothesis must be rejected

Source	DF	Type III SS	Mean Square	F Value	Pr > F	Adj Pr > F	
						G - G	H - F
learn	3	262.700	87.567	103.697	<0.0001	<0.0001	<0.0001
Error(learn)	27	22.800	0.844				

Greenhouse-Geisser Epsilon	0.5328
Huynh-Feldt Epsilon	0.6658

Tests of Within-Subjects Effects

12. What is NOT a form of counterbalancing?

    a. Even-number algorithms

    b. Odd-number algorithms

    c. Random number algorithms

    d. Heuristics *

13. Which of the following is NOT a source of variability in repeated measures ANOVA,

    a. between factors *

    b. between treatments

    c. between individuals

    d. residual.

14. In a repeated measures design with one factor of four levels and 3 participants, what is the residual degrees of freedom?

    a. 3

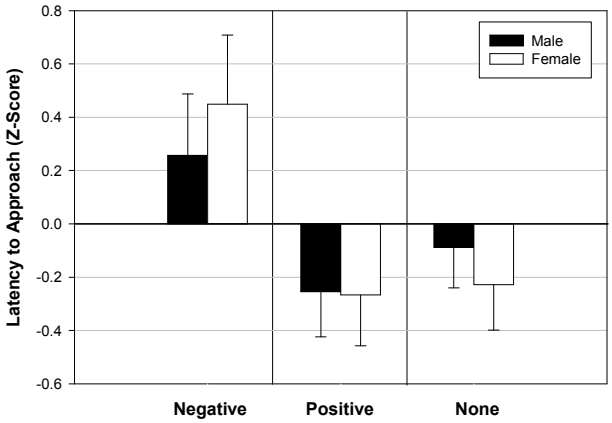
b. 2

c. 12

d. 11 *

Ch. 14 Mixed Design ANOVA

1. Field & Lawson (2003) reported the effects of giving 7-9 year old children positive, negative or no information about novel animals (Australian marsupials). This variable was called 'Infotype'. Gender of the child was also examined. The outcome was the time taken for the children to put their hand in a box in which they believed either the positive, negative, or no information animal was housed (Positive values = longer than average approach times, negative values = shorter than average approach times). Based on the output below, what could you conclude? [see Field, A. P., & Lawson, J. (2003). Fear information and the development of fears during childhood: effects on implicit fear responses and behavioural avoidance. *Behaviour Research and Therapy*, *41*, 1277–1293.]



Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
INFOTYPE	Sphericity Assumed	9.177	2	4.588	7.283	.001
	Greenhouse-Geisser	9.177	1.940	4.730	7.283	.001
	Huynh-Feldt	9.177	2.000	4.588	7.283	.001
	Lower-bound	9.177	1.000	9.177	7.283	.010
INFOTYPE * GENDER	Sphericity Assumed	.599	2	.299	.475	.623
	Greenhouse-Geisser	.599	1.940	.309	.475	.618
	Huynh-Feldt	.599	2.000	.299	.475	.623
	Lower-bound	.599	1.000	.599	.475	.495
Error(INFOTYPE)	Sphericity Assumed	51.664	82	.630		
	Greenhouse-Geisser	51.664	79.544	.650		
	Huynh-Feldt	51.664	82.000	.630		
	Lower-bound	51.664	41.000	1.260		

Tests of Between-Subjects Effects

Measure: MEASURE_1
Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	2.034E-02	1	2.034E-02	.049	.826
GENDER	1.822E-03	1	1.822E-03	.004	.948
Error	17.109	41	.417		

Source	DF	Type III SS	Mean Square	F Value	Pr > F	Adj Pr > F G - G	Adj Pr > F H - F
Infotype	2	9.177	4.588	7.283	0.0010	0.0014	0.0016
infotype*GENDER	2	0.599	0.299	0.475	0.6234	0.6181	0.6298
Error(drink)	82	51.664	0.630				

Greenhouse-Geisser Epsilon	0.941
Huynh-Feldt Epsilon	0.876

Source	DF	Type III SS	Mean Square	F Value	Pr > F
GENDER	1	203.421	203.421	0.049	0.8247
Error	41	17.109	0.4165	0.004	0.6481

a. Approach times were significantly different for the boxes containing the different animals, but the pattern of results was affected by gender.

b. Approach times were significantly different for the boxes containing the different animals, but the pattern of results was unaffected by gender.*

c. Approach times were not significantly different for the boxes containing the different animals, but the pattern of results was affected by gender.

d. Approach times were not significantly different for the boxes containing the different animals, but the pattern of results was unaffected by gender.

2. Based on the information in the previous question, what analysis has been done?

   a. A two-way Mixed ANOVA.*

   b. A Three-way Mixed ANOVA.

   c. A two-way repeated measured ANOVA.

   d. A Two-way Independent ANOVA.

3. For the same data as in the previous question, contrasts were performed. Based on the SAS output given, which of the following statements is true? (Levels of Infotype were entered in the following order: negative information, positive information, no information)

a. Approach times for the box containing the negative animal were not significantly different to those for the box containing the positive information animal.

b. Approach times for the box containing the positive animal were significantly shorter to the box containing the control (no information) animal.

c. The profile of results were different for boys and girls.

d. Approach times for the box containing the negative animal were significantly longer than for the box containing the control (no information) animal.*

5. Which of the following is a mixed design?

a. An investigation of the effect of sex of participant on age of attaining a degree

b. An investigation of the effect of the sex of the participant on driving simulator errors before and after drinking alcohol *

c. An investigation of the effect sex of participant on driving simulator errors with and without training

d. An investigation of the effect of sex of participant on choice of degree topic.

6. A mixed factorial design

a. Is one in which both men and women take part

b. Has at least one between subjects variable and one within subjects variable. *

c. Utilises both categorical and continuous

d. Needs a non-parametric tests

7. A study investigates whether there are personality differences between students taking different courses at University. Every student on psychology, maths and drama courses fills in a personality test with five dimensions.

a. Personality dimension is an independent measures factor and course is a repeated measures factor

b. Personality dimension is a repeated measures factor and course is a independent measures factor *

c. Both factors are independent measures

d. Both factors are repeated measures

6. The results from the above experiment are displayed in the table below What do these results indicate?

a. There are no effects

b. There is an interaction effect and no main effects

c. There are two main effects and no interaction *

d. There are two main effects and an interaction

Source	DF	Type III SS	Mean Square	F Value	Pr > F	Adj Pr > F	
						G - G	H - F
Person	4	259.135	64.784	255.122	<.0001	<.0001	<.0001
person*universitycourse	8	3.797	.475	1.869	0.060	0.071	0.071
Error(person)	4328	1099.019	.254				

Source	DF	Type III SS	Mean Square	F Value	Pr > F
universitycourse	2	12.935	6.467	81656.468	<.0001
Error	1082	1148.276	1.061		

Ch. 15 Non-parametric Tests

1. A researcher was interested in stress levels of lecturers during lecturers. She took the same group of 8 lecturers and measured their anxiety (out of 15) during a normal lecture and again in a lecture in which she had paid students to be disruptive and misbehave. The data were not normally-distributed. Which test should she use to compare her experimental conditions?

    a. Paired *t*-test.

    b. Mann-Whitney test.

    c. Wilcoxon signed ranks test.*

    d. Wilcoxon two sample test.

2. Another term for non-parametric tests is

    a. Non-normal tests

b. Data-free tests
c. Non-continuous tests
d. Distribution-free tests *

3. The non-parametric equivalent of the paired t-test is the

a. Mann-Whitney U test / Wilcoxon two sample test
b. Wilcoxon sign test *
c. Friedman test
d. Kruskall-Wallis test

4. The non-parametric equivalent of the two-sample independent t-test is the

a. Mann-Whitney U test / Wilcoxon two sample test*
b. Wilcoxon sign test
c. Friedman test
d. Kruskall-Wallis test

5. The non-parametric equivalent of the one-way between subjects anova is

a. Mann-Whitney U test / Wilcoxon two sample test
b. Wilcoxon sign test
c. Friedman test
d. Kruskall-Wallis test *

6. The non-parametric equivalent of the one-way repeated measures anova is

a. Mann-Whitney U test/ Wilcoxon two sample test
b. Wilcoxon sign test
c. Friedman test *
d. Kruskall-Wallis test

7. If the null hypothesis is true and we run the Wilcoxon two sample test test on data, the expectation is that what in the two groups will be approximately equal.

a. Means
b. Ranks
c. Variances

d. Mean ranks *

8. What might be a reason to choose parametric tests over non-parametric tests even if some parametric assumptions are violated?

   a. Non-parametric tests are harder to carry out
   b. Non-parametric tests are less powerful *
   c. Parametric tests are less robust
   d. Parametric tests are more likely to show causal effects

10. 10 visitors to an art gallery are asked to rate two sculptures for aesthetic value on a scald of 1(low value) to 5 (high value) What procedure would be used to test the hypothesis that the ratings are not significantly different?

   a. Mann-Whitney U test / Wilcoxon two sample test
   b. Wilcoxon sign test *
   c. Friedman test
   d. Kruskall-Wallis test

11. In q8 the following results are found. What conclusion would be drawn?

Test Statistics(b)

Z	-2.842
One-Sided Pr < Z	0.0042
Two-Sided Pr > |Z|	0.0084

a Based on positive ranks.

   a. There is a significant difference in rating with the Henry Moor peace being rated higher than the Michelangelo piece
   b. There is no significant difference in ratings
   c. There is a significant difference in rating with the Henry Moore piece being rated lower than the Michelangelo piece*
   d. Not enough information

12. The same people in the above study are asked to rate a Van Gogh painting too. What test would be used to see if there is a significant difference in ratings amongst the three pieces?

    a. Mann-Whitney U test
    b. Wilcoxon sign test
    c. Friedman test *
    d. Kruskall-Wallis test

13. The results from Q12 are below. What conclusions would be drawn?

Ranks

Cochran-Mantel-Haenszel Statistics (Based on Rank Scores)				
Statistic	**Alternative Hypothesis**	**DF**	**Value**	**Prob**
1	**Nonzero Correlation**	1	12.487	<0.0001
2	**Row Mean Scores Differ**	2	18.667	<0.0001

Analysis Variable : COL1 Values of COL1 Were Replaced by Ranks		
NAME OF FORMER VARIABLE	**N Obs**	**Mean**
Michelangelo	10	3.00
Henry Moore	10	1.20
Van Gogh	10	1.80

a. There is a significant difference in ratings, and the Michelangelo is higher than the Van Gogh which is higher than the Henry Moore *
b. There is a significant difference in ratings with the Henry Moore being higher than the van Gogh which is higher than the Michelangelo
c. There is no significant difference in ratings
d. Not enough information

14. The researchers find out that the curator of the art gallery has misunderstood the instructions and in fact ten *different* people have been ratings the different pieces of art. What test should they now employ?

a. Mann-Whitney U test / Wilcoxon Two sample test
b. Wilcoxon sign test
c. Friedman test
d. Kruskall-Wallis test*

15. They did this test and the results below are found. What conclusion can be drawn?

Wilcoxon Scores (Rank Sums) for Variable SPERM Classified by Variable soya					
Art	**N**	**Sum of Scores**	**Expected Under H0**	**Std Dev Under H0**	**Mean Score**
Michelangelo	10	255.00	155.00	90.0	25.50
Henry Moore	10	75.00	155.00	90.0	7.50
Van Gogh	10	135.00	155.00	90.0	13.50

Kruskal-Wallis Test	
Chi-Square	23.725
DF	2
Pr > Chi-Square	<.0001

a. There is a significant difference among the ratings, with Henry Moore rate highest and Michelangelo lowest

b. There is a significant difference amongst the ratings with the Michelangelo rated highest and Henry Moore lowest

c. There is no significant difference among the ratings

d. Not enough information

Ch. 16 Multivariate Analysis of Variance

1. A psychologist was interested in gauging the success of a mood manipulation during one of her experiments. She had three groups of participants who underwent different types of mood induction: disgust mood induction, negative mood induction and positive mood induction. After the mood induction, participants were asked to endorse nine statements relating to their mood (on a 5 point Likert scale from 1—disagree to 5—agree): (1) When you're smiling the whole world smiles with you, (2) I love the pretty flowers, (3) I could never touch a dead body, (4) I would never eat cat food, (5) If someone served me monkey brain soup I would vomit, (6) I feel fed up, (7) Bodily fluids are nasty, (8) I could not drink from a glass that I'd used to catch a spider, (9) I am a worthless piece of scum. What analysis should be done to see if the mood inductions had an effect on responses to these 9 items.

   a. Factor analysis.

   b. MANOVA.*

   c. Repeated Measures ANOVA.

   d. Mixed ANOVA.

2. A psychologist was interested in gauging the success of a mood manipulation during one of her experiments. She had three groups of participants who underwent different types of mood induction: disgust mood induction, negative mood induction and positive mood induction. After the mood induction, participants were asked to endorse nine statements relating to their mood (on a 5 point Likert scale from 1—disagree to 5—agree): (1) When you're smiling the whole world smiles with you, (2) I love the pretty flowers, (3) I could never touch a dead body, (4) I would never eat cat food, (5) If someone served me monkey brain soup I would vomit, (6) I feel fed up, (7) Bodily fluids are nasty, (8) I could not drink from a glass that I'd used to catch a spider, (9) I am a worthless piece of scum. What analysis should be done to see if the mood inductions had an effect on responses to these 9 items. Part of the SAS output is below. Which of the following statements best summarizes the output.

MANOVA Test Criteria and F Approximations for the Hypothesis of No Overall group Effect H = Type III SSCP Matrix for group E = Error SSCP Matrix S=2 M=-0.5 N=12					
Statistic	**Value**	**F Value**	**Num DF**	**Den DF**	**Pr > F**
Wilks' Lambda	0.615	1.772	18	118	0.0372
Pillai's Trace	0.416	1.723	18	116	0.0445
Hotelling-Lawley Trace	0.575	1.820	18	114	0.0308
Roy's Greatest Root	0.465	30.48	9	59	0.0046
NOTE: F Statistic for Roy's Greatest Root is an upper bound.					
NOTE: F Statistic for Wilks' Lambda is exact.					

a. The type of mood induction had a significant effect on responses to all of the 9 items.

b. The type of mood induction had a significant effect on responses to at least one of the 9 items.

c. The type of mood induction that a person had could be determined from a linear combination of responses to the 9 items.*

d. The type of mood induction had a significant effect on responses to more than half at least of the 9 items.

4. A selection of the next part of output is shown below. Which statement best sums up this part of the output?

Dependent Variable: When you're smiling the whole world smiles with you

Source	DF	Type III SS	Mean Square	F Value	Pr > F
group	2	339.792	169.896	1.380	0.2594

Dependent Variable: I love the pretty flowers

Source	DF	Type III SS	Mean Square	F Value	Pr > F
group	2	3.816	1.908	1.684	0.1942

Dependent Variable: I could never touch a dead body

Source	DF	Type III SS	Mean Square	F Value	Pr > F
group	2	3.455	1.728	2.524	0.088

Dependent Variable: I would never eat cat food

Source	DF	Type III SS	Mean Square	F Value	Pr > F
group	2	12.710	6.355	9.098	<0.0001

Dependent Variable: If someone served me monkey brain soup I would vomit

Source	DF	Type III SS	Mean Square	F Value	Pr > F
group	2	3.746	1.873	2.322	0.1057

Dependent Variable: I feel fed up

Source	DF	Type III SS	Mean Square	F Value	Pr > F
group	2	5.594	2.797	2.739	0.0724

Dependent Variable: Bodily fluids are nasty

Source	DF	Type III SS	Mean Square	F Value	Pr > F
group	2	3.712	1.866	3.856	0.0261

Dependent Variable: I could not drink from a glass that I'd used to catch a spider

Source	DF	Type III SS	Mean Square	F Value	Pr > F
group	2	0.989	0.494	0.271	0.7640

Dependent Variable: I am a worthless piece of scum

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Group	2	2.923	1.461	2.253	0.113

a. There were significant differences between the mood induction conditions on all items.

b. There were significant differences between the mood induction conditions on two items: 'I would never eat catfood', and 'Bodily fluids are nasty'.*

c. There were significant differences between the mood induction conditions on four items: 'I would never eat catfood', 'I could never touch a dead body', 'I feel fed up' and 'Bodily fluids are nasty'.

d. The mood induction had no effect on responses to the 9 items.

5. Multivariate Analysis of Variance (MANOVA) is

a. An extension of analysis of variance with more than one interaction *

b. An extension of analysis of variance used to accommodate more than one dependent variable.

c. An extension of analysis of variance with more than two independent variables

d. An extension of multiple regression that allows the variance to calculated from means

6. MANOVA measures

a. The variances amongst the correlations between many dependent variables*

b. The variances amongst the correlations between many dependent variables

c. the group differences between two or more dependent variables

d. the group differences between two or more independent variables

7. What is NOT an advantage of MANOVA?

a. Researchers can examine several dependent measures at once.

b. It controls the overall error-rate, ensuring the risk of Type I errors is not increased
c. It can detect dependent measures which are not theoretically sound*
d. It may be able to detect combined differences in the dependent variables not found by examining the dependent variables independently of one another.

8. What is NOT a requirement or recommendation of the use of MANOVA

a. Larger sample sizes that ANOVA
b. The sample in each cell must be greater than the number of dependent variables included.
c. Dependent variables should be continuous
d. Dependent variables should be correlated *

9. What is NOT an assumption to be met before the use of MANOVA?

a. All observations must be related*
b. There must be Equality of Variance-Covariance Matrices
c. All variables must be multivariate normal
d. The joint effect of thee two variables must be normally distributed.

9. Manova needs a sample size _____ the sample size in anova

a. Equal to
b. Smaller than
c. Larger than *
d. Twice

11. Independent variables in MANOVA can be selected after the initial design. In this case the variables are added as

e. Blocked factors
f. Random factors
g. Fixed factors
h. Blocking factors *

12. In MANOVA the effects of covariates can be evaluated by

    i. A regression equation *
    j. An examination of the mean differences
    k. An examination of the correlation matrix
    l. A correlation equation

13. Which is NOT a test that can be used to assess multivariate differences in MANOVA?

    a. Roy's Greatest Root
    b. Wilks' lambda
    c. Greenhouse-Geisser *
    d. Hotelling's trace

15. A discriminate function analysis was performed on the data in the previous examples.

	Canonical Correlation	Adjusted Canonical Correlation	Approximate Standard Error	Squared Canonical Correlation	Eigenvalues of Inv(E)*H = CanRsq/(1-CanRsq)			
					Eigenvalue	Difference	Proportion	Cumulative
1	0.500822	0.441441	0.139119	0.250823	0.465	0.355	0.809	0.809
2	0.260061	.	0.173136	0.067632	0.110		0.191	1.000

16.

	Test of H0: The canonical correlations in the current row and all that follow are zero				
	Likelihood Ratio	Approximate F Value	Num DF	Den DF	Pr > F
1	0.69850905	2.55	4	52	0.0497
2	0.93236803	1.96	1	27	0.1731

17. The output is below. Which statement best sums up the results.

	Test of H0: The canonical correlations in the current row and all that follow are zero				
	Likelihood Ratio	**Approximate F Value**	**Num DF**	**Den DF**	**Pr > F**
1	30.128	5.41	18	52	0.0362
2	6.452	1.96	8	27	0.5968

Pooled Within-Class Standardized Canonical Coefficients			
Variable	**Label**	**Can1**	**Can2**
Q1	**I would never eat cat food**	**0.694**	**0.145**
Q2	**Bodily fluids are nasty**	**0.307**	**0.071**
Q3	**If someone served me monkey brain soup I would vomit**	**0.198**	**0.225**
Q4	**When you're smiling the whole world smiles with you.**	**-0.222**	**0.150**
Q4	**I would not drink from a glass that I'd used to catch a spider**	**0.522**	**-0.191**
Q5	**I feel fed up**	**-0.194**	**-0.915**
Q6	**I could never touch a dead body**	**-0.065**	**-0.174**
Q7	**I love the pretty flowers**	**-0.297**	**0.196**
Q8	**I am a worthless piece of scum**	**0.293**	**0.506**

Pooled Within Canonical Structure			
Variable	**Label**	**Can1**	**Can2**
Q1	I would never eat cat food	0.767	-0.135
Q2	Bodily fluids are nasty	0.501	-0.026
Q3	If someone served me monkey brain soup I would vomit	0.389	0.013
Q4	When you're smiling the whole world smiles with you.	-0.275	0.248
Q4	I would not drink from a glass that I'd used to catch a spider	0.133	0.013
Q5	I feel fed up	0.249	0.703
Q6	I could never touch a dead body	0.350	-0.421
Q7	I love the pretty flowers	-0.262	0.416
Q8	I am a worthless piece of scum	0.339	0.366

a. There were two significant underlying functions that differentiated the mood induction groups, one seems to reflect disgust, whereas the other reflects depression.

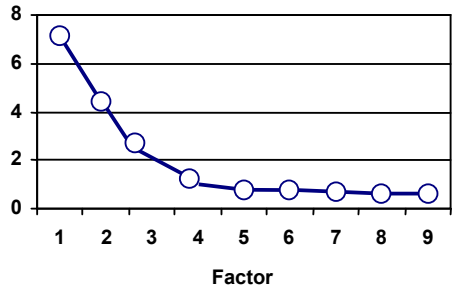
b. There was one significant underlying function that differentiates the mood induction groups, it seems to represent disgust.*

c. There were two significant underlying functions that differentiated the mood induction groups, but it's unclear what these functions represent.

d. There were no significant underlying functions that could discriminate the mood-induction groups.

Ch. 17 Exploratory Factor Analysis

1. Based on this scree plot, how many factors should be extracted?



a. 2.
b. 3.*
c. 4.
d. 5.

2. Varimax rotation should be used when,
   a. Factors are expected to correlate.
   b. Factors are non-orthogonal.
   c. Factors are independent.*
   d. Kaiser's criterion is met.

3. Oblique rotation should be used when,
   a. Factors are expected to correlate.*
   b. Factors are orthogonal.
   c. Factors are independent.
   d. Kaiser's criterion is met.

4. A scree plot in factor analysis is a plot of:
   a. The factor number against its eigenvalue.*
   b. The factor loadings of each variable onto each factor.
   c. The correlations between variables.
   d. The regression coefficient of each variable with each factor.

5. Kaiser's criterion for retaining factors is:

a. Retain any factor with an eigenvalue greater than 0.7.

b. Retain any factor with an eigenvalue greater than 1.*

c. Retain factors before the point of inflexion on a scree plot.

d. Retain factors with communalities greater than 0.7.

6. Which of these is a form of oblique rotation?

a. Varimax.

b. Quartimax.

c. Equamax.

d. Promax.*

7. What does the following output from a factor analysis tell us?

Kaiser's Measure of Sampling Adequacy: Overall MSA = 0. 7025484

a. The sample size is sufficient, but there is multicollinearity in the data.

b. The sample size is inadequate, and there is multicollinearity in the data.

c. The sample size is adequate, and the correlations in the correlation matrix are significantly bigger than zero.*

d. The sample size is adequate, but the correlations in the correlation matrix are not big enough.

8. Based on the following output, which item on this questionnaire would improve the reliability of the questionnaire the most if it was removed?

Cronbach Coefficient A lpha	
Variables	**Alpha**
Raw	0.9118
Standardized	0.9152

Cronbach Coefficient Alpha with Deleted Variable					
	Raw Variables		Standardized Variables		
Deleted Variable	Correlation with Total	Alpha	Correlation with Total	Alpha	Label
Q1	.5505	.9102	.5505	0.9081	Q1
Q2	.4917	.9092	0.4889	0.9017	Q2
Q3	.5720	.9025	0.5707	0.9033	Q3
Q4	.7145	.9046	0.6973	0.9042	Q4
Q5	.6301	.9058	0.6206	0.9043	Q5
Q6	.6214	.9052	0.6372	0.9060	Q6
Q7	.6857	.9055	0.6349	0.9062	Q7
Q8	.6254	.9056	0.6328	0.9066	Q8
Q9	.6214	.9048	0.6563	0.9078	Q9
Q10	.5014	.9084	0.5371	0.9141	Q10
Q12	.2235	.9156	0.2442	0.9248	Q12
Q14	.5698	.9078	0.5493	0.9105	Q14
Q16	.4747	.9108	0.4415	0.9064	Q16
Q17	.6898	.9041	0.6803	0.9065	Q17
Q18	.6347	.9051	0.6442	0.9084	Q18
Q19	.5898	.9076	0.5753	0.9108	Q19
Q20	.5874	.9095	0.4894	0.8996	Q20
Q21	.7762	.9015	0.7614	0.9081	Q21

a. Q12.*

b. Q16.

c. Q21.

d. Q4.

9. Most researchers use exploratory factor analysis to:

a. Confirm the data are real

b. Determine the number of factors/constructs underlying a set of variables *

c. Reduce the data to a smaller number of variables

d. Confirm the number of factors

10. Which statement is NOT true of Exploratory factor analysis

a. EFA identifies the factor structure or model for a set of variables,

b. EFA establishes the number of principal underlying factors in the data

c. EFA identifies the pattern seen in the correlations of each variable to the factors

d. EFA confirms the number of constructs identified in previous research*

11. Which procedure would you NOT use to determine the number of factors to be included in your interpolation of an exploratory factor analysis?

    a. Select the number of factors with eigenvalues of 1.00 or higher
    b. Examine a scree plot of eigenvalues plotted against the factor numbers
    c. Disregard any communalities*
    d. Analyze increasing numbers of factors; stop when all non-trivial variance is accounted for

12. Which of the following must be met for EFA?

    a. Presence of relationships determined by the correlation matrix *
    b. Sphericity determined by a Bartlett test
    c. Normal distribution in the variables determined by a Kolmogorov-Smirnov tests
    d. Interaction between the variables determined by anova

13. Principal component analysis is

    a. Used to summarise data whilst retaining maximum variance *
    b. Used to summarise whilst retaining minimum variance
    c. Derive as few factors as possible
    d. Derive as many solutions as possible

14. Factor loadings are

    a. The weights of each factors
    b. The weights of each variable
    c. Correlations between each variable and each factor *
    d. Correlations between all the variables

15. Rotation means

    a. Turning the matrix on one side
    b. Simplifying the loadings
    c. Interpretation of the factors*

d. Interpretation of the graph

Ch. 18 Categorical Data

1. 933 people were asked which type of programme they prefer to watch on television. Results are below. What is the *expected* frequency for men who liked to watch sport?

	News	Documentaries	Soaps	Sport	Total
Women	108	123	187	62	480
Men	130	123	68	132	453
Total	238	246	255	194	933

a. 132

b. 94.19*

c. 64.09

d. 27.45

2. Based on the data above, what are the odds of being a man if you watch sport?

a. 0.47

b. 0.14

c. 0.41

d. 2.13*

2. For the same data, a chi square test produced the SAS output below. What can we conclude from this output?

Statistic	DF	Value	Prob
Chi-Square	1	82.112	<.0001
Likelihood Ratio Chi-Square	1	84.840	<.0001
Mantel-Haenszel Chi-Square	1	83.876	<.0001

9.

a. Women watched significantly more programs than men.

b. Significantly more soap operas were watched.

c. The profile of programs watched was significantly different between men and women.*

d. Men and women watch similar types of programs.

4. Chi-square is a test of

a. Difference,

b. Relationship

c. Association *

d. Factors

6. A calculated value of Chi Square:

a. compares the frequencies of categories of items in a sample to the frequencies that are expected in the population *

b. compares the frequencies of categories in the population to those expected in the sample

c. compares the mean number of categories in a sample to those in the population

d. compares the mean number of frequencies in a population to those in the sample

7. Which is an assumption of chi-square?

a. That the data are normally distributed

b. That each subject contributes data to only one cell b*

c. That the data is continuous

d. That there is little variability amongst the data

8. When testing several categorical variables, which is the appropriate test of relationship?

a. Chi-square

b. Elaborated chi-square

c. Part correlation

d. Log-linear analysis*

9. In the following table, what number is missing? (marked with ?)

SEX * GROUPS Crosstabulation

			GROUPS				Total
			A	B	C	D	
SEX	female	Count	6	3	3	4	16
		Expected	5.1	2.9	4.6	3.4	16.0
	male	Count	3	2	5	2	12
		Expected	3.9	2.1	3.4	?	12.0
Total		Count	9	5	8	6	28
		Expected	9.0	5.0	8.0	6.0	28.0

a. 6
b. 2.6 *
c. 1.4
d. 9.4

10. Loglinear analysis is:

a. A multivariate alternative to chi-square *
b. A multivariate equivalent to linear regression
c. An analytical form of logistic regression
d. A way of working of logarithms when there are a lot of numbers

11. Loglinear analysis is NOT:

a. is a goodness-of-fit test that allows you to test all the effects
b. a test that employs an algorithm to generate expected cell frequencies for each model
c. a test that will find the model that best represents the data.
d. a test that employs a differential analysis *

12. Which of the following is NOT an assumption to be met for loglinear analysis?

a. Cells of the contingency table must be independent
b. All cells must have expected frequencies greater than 5

c. All cells must have expected frequencies greater than 1 *

d. All of the above

13. What data transformations are necessary before loglinear analysis?

a. Data reduction

b. Logarithmic *

c. Linear regression

d. Summary statistics

14. Which of the following is an advantage of loglinear analysis?

a. It allows analysis of different types of data

b. It provides a systematic approach to the analysis of complex multidimensional tables. *

c. Empty cells do not lower the power of the test

d. It means you do not have to compare models