MCQs For Lecturers

To be used in conjunction with Field, A. P., Miles, J., and Field, Z. C. (2012). *Discovering statistics using R: and sex and drugs and rock 'n' roll*. London: Sage. Questions are listed under the chapter they best represent. Correct answers are denoted with a *.

Chapter 1

1. What is a confounding variable?
    a. A variable that is manipulated by the experimenter.
    b. A variable that affects the outcome being measured as well as or instead of the independent variable.*
    c. A variable that has not been measured.
    d. A variable that is made up only of categories.
2. 'Children can learn a second language faster before the age of 7'. Is this statement:
    a. A null hypothesis.
    b. A non-scientific statement.
    c. A two-tailed hypothesis.
    d. A one-tailed hypothesis.*
3. If a psychological test is valid, what does this mean?
    a. The test will give consistent results.
    b. The test measures what it claims to measure.*
    c. The test has internal consistency.
    d. The test measures a psychologically useful variable.
4. If my null hypothesis is 'Dutch people do not differ from English people in height', what is my alternative hypothesis?
    a. Dutch people are taller than English people.
    b. English people are taller than Dutch people.
    c. Dutch people differ in height from English people.
    d. All of the above are plausible alternative hypotheses.*
5. When questionnaire scores predict, or correspond with, external measures of the same construct that the questionnaire measures it is said to have:
    a. Ecological validity.
    b. Factorial validity.
    c. Content validity.

d. Criterion validity.*

6. A variable manipulated by a researcher is known as:
    a. A dependent variable.
    b. A confounding variable.
    c. A discrete variable.
    d. An independent variable.*
7. A predictor variable is another name for:
    a. A dependent variable.
    b. A confounding variable.
    c. A discrete variable.
    d. An independent variable.*
8. What kind of variable is IQ, measured by a standard IQ test?
    a. Categorical.
    b. Discrete.
    c. Nominal.
    d. Continuous.*
9. A frequency distribution in which high scores are most frequent (i.e. bars on the graph are highest on the right-hand side) is said to be:
    a. Positively skewed.
    b. Leptokurtic.
    c. Platykurtic.
    d. Negatively skewed.*
10. A frequency distribution in which there are too few scores at the extremes of the distribution is said to be:
    a. Positively skewed.
    b. Leptokurtic.*
    c. Platykurtic.
    d. Negatively skewed.
11. Which of the following is designed to compensate for practice effects?
    a. A repeated measures design.
    b. Randomization of participants.
    c. Counterbalancing.*
    d. A control condition.
12. Variation due to variables that have not been measured is known as:

a. Unsystematic variance.*

b. Homogeneous variance.

c. Systematic variance.

d. Model variance.

13. 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

Chapter 2

1. The degree to which a statistical model represents the data collected is known as the:
    a. Fit.*
    b. Homogeneity.
    c. Reliability.
    d. Validity.
2. Which of the following is true about a 95% confidence interval for 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 confidence intervals will contain the population mean.*
    d. There is a .05 probability that the population mean falls within the limits of the confidence interval.
3. What is *p* the probability of?
    a. *p* is the probability that the results are due to chance, the probability that the null hypothesis (H_0) is true.
    b. *p* is the probability of observing results as extreme as (or more extreme than) observed, if the null hypothesis (H_0) is true.*
    c. *p* is the probability that the results are not due to chance, the probability that the null hypothesis (H_0) is false.
    d. *p* is the probability that the results would be replicated if the experiment was conducted a second time.
4. A Type I error is when:
    a. We conclude that there is an effect in the population when in fact there is not.*
    b. We conclude that there is not an 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 entered into **R** is different than the data collected.
5. If we calculated an effect size and found it was $r = .21$, which expression would best describe the size of effect?
    a. Small.
    b. Small to medium.*

c. Large.

d. Medium to large.

Below is a frequency distribution from www.amazon.co.uk of a CD called *Some Loud Thunder* by an artist called 'Clap Your Hands Say Yeah' (13 customer reviews):

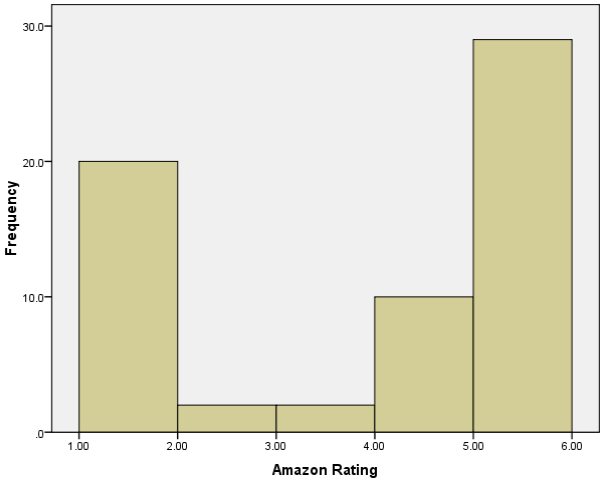
5 star: (3)
4 star: (6)
3 star: (2)
2 star: (1)
1 star: (1)

6. Using the data in the frequency distribution, what is the mode of the data?
    a. 4.00*
    b. 3.69
    c. 1.00
    d. 3.45
7. Using the data in the frequency distribution, what would be our estimate of the standard deviation in the population?
    a. 1.29
    b. 1.40
    c. 1.14
    d. 1.18*
8. Using the data in the frequency distribution, what is the range of the data?
    a. 5
    b. 4*
    c. 3
    d. 1
9. What is the relationship between the sum of squared errors (SS), the sample size (n) and the variance (s^2)?
    a. $SS = s^2/(n - 1)$
    b. $s^2 = SS/(n - 1)$*
    c. $s^2 = SS(n - 1)$
    d. $n = (s^2/SS) - 1$
10. Below is a histogram of ratings of Britney Spears's CD *Britney*. What can we say about the data from this histogram?
    a. The data are normal.

b. The data are approximately bimodal.*

c. The median rating was 2.

d. The data are leptokurtic.



Chapter 3

1. What is a working directory?
    a. It is the console in which **R** commands are typed.
    b. It is the default location where **R** will search for and save files.*
    c. It is a list of work contacts.
    d. It is a collection of commands typed into **R** in one session.

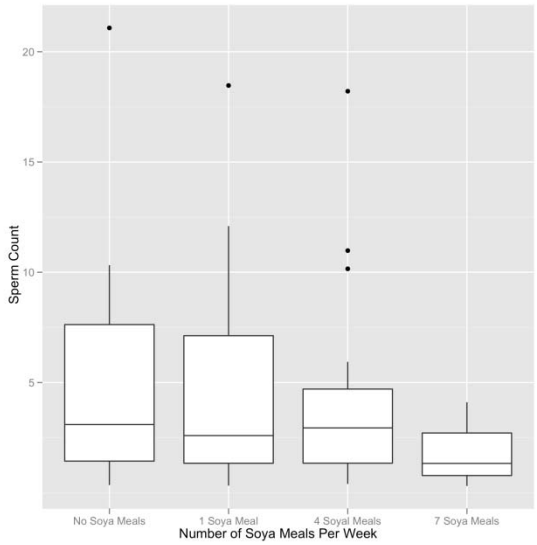
2. The *subset()* function can be used to:
    a. Reshape your data.
    b. Select parts of your dataframe.
    c. Create a new dataframe from an existing dataframe.
    d. Both b and c.*

3. How many variables does the dataframe below contain:
    a. 4
    b. 5
    c. 2*
    d. 3

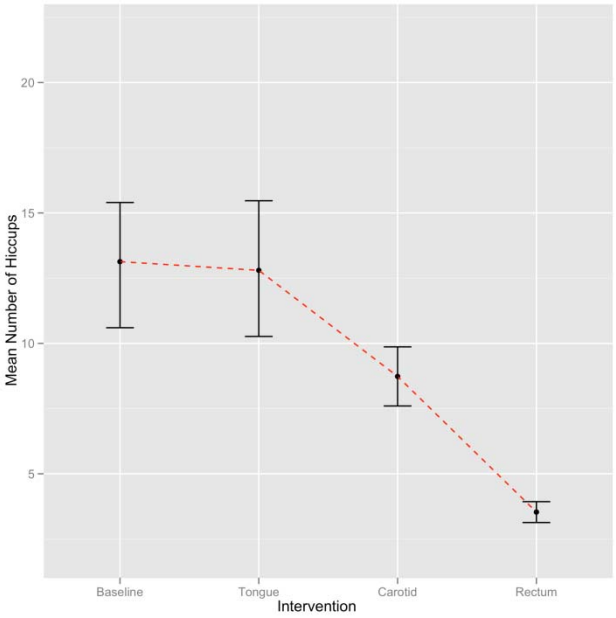
```
   Name  Age
1  Lars   47
2  James  47
3  Kirk   48
4  Rob    46
```

4. Let's imagine we had stored some data in a CSV file called **Lecturer Data.csv** (you can find this file on the companion website). To load these data into a dataframe we could execute the following command:
    a. `lecturerData<-read.delim("Lecturer Data.dat", header = TRUE)`
    b. `lecturerData = read.csv("Lecturer Data.csv", header = TRUE)`*
    c. `lecturerData<-read.delim("Lecturer Data.txt", header = TRUE)`
    d. Any of the above would work.

Chapter 4



1. What is the above graph known as?
    a. A scatterplot.
    b. A histogram.
    c. A boxplot.*
    d. An error bar chart.
2. Based on the above chart, what was the interquartile range of sperm count for 'No soya meals' (approximately).
    a. 7.5
    b. 5.5*
    c. 9.0
    d. 20.0



3. Looking at the graph above, which intervention is the best cure for hiccups?
    a. Tongue.
    b. Carotid.
    c. Rectum.*
    d. None of the interventions reduced the mean number of hiccups.

4. If we wanted to add a red straight regression line to the above scatterplot, which of the following commands should we add to the code?
    a. `+ geom_smooth(colour = "Red")`
    b. `+ geom_smooth(method = "lm")`
    c. `+ geom_smooth(method = "lm", colour = "Red")`*
    d. `+ geom_straight(method = "lm", colour = "Red")`

Chapter 5

1. Which of the following is least affected by outliers?
    a. The range.
    b. The mean.
    c. The median.*
    d. The standard deviation.
2. 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 Shapiro–Wilk test.
    d. None of the above because of the large sample size.*
3. Which of the following transformations is most useful for correcting skewed data?
    a. Log transformation.*
    b. Tangent transformation.
    c. Arcsine transformation.
    d. Cosine transformation.
4. 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 interquartile range.

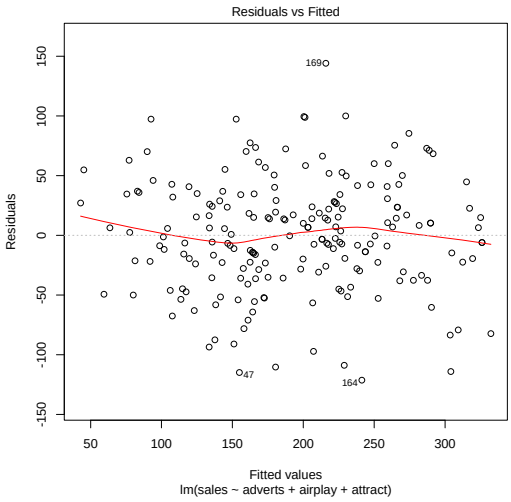
Chapter 6

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. 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 on ranked data.
3. How much variance has been explained by a correlation of .9?
    a. 81%*
    b. 18%
    c. 9%
    d. None of the above.
4. 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.

Chapter 7

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 variables 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 outliers is not true?
    a. Outliers are values very different from the rest of the data.
    b. Outliers have an effect on the mean.
    c. Outliers have an effect on regression parameters.
    d. Outliers are influential cases.*
4. For which regression assumption does the Durbin–Watson statistic test?
    a. Linearity.
    b. Independence of errors.*
    c. Homoscedasticity.
    d. Multicollinearity.
5. Using the model in Chapter 5, how many records would be predicted to be sold if £29,000 was spent on advertising, the record was played 19 times on radio and the band were rated 7 on the attractiveness scale?
    a. 2,461,660 records.
    b. 2435 records.
    c. 2488 records.
    d. 2,435,050 records.*

6. The following graph shows:



a. Non-linearity.

b. Heteroscedasticity and non-linearity.

c. Regression assumptions that have been met.*

d. Heterscedasticity

Recent research has shown that lecturers are among the most stressed workers. A researcher wanted to know exactly what it was about being a lecturer that created this stress and subsequent burnout. She recruited 75 lecturers and administered several questionnaires that measured: **Burnout** (high score = burnt out), **Perceived Control** (high score = *low* perceived control), **Coping Ability** (high score = *low* ability to cope with stress), **Stress from Teaching** (high score = teaching creates a lot of stress for the person), **Stress from Research** (high score = research creates a lot of stress for the person), and **Stress from Providing Pastoral Care** (high score = providing pastoral care creates a lot of stress for the person). The outcome of interest was burnout, and Cooper's (1988) model of stress indicates that perceived control and coping style are important predictors of this variable. The remaining predictors were measured to see the unique contribution of different aspects of a lecturer's work to their burnout. The **R** output is below and the remaining questions relate to this output.

```
summary(burnoutModel.1)

Call:
glm(formula = burnout ~ loc + cope, family = binomial(), data = burnoutData)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-2.9217  -0.5163  -0.3730   0.1273   2.0848

Coefficients:
             Estimate Std. Error z value Pr(>|z|)
```

```
(Intercept) -4.484493   0.379458 -11.818  < 2e-16 ***
loc          0.061080   0.010915   5.596 2.19e-08 ***
cope         0.082714   0.009369   8.829  < 2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 530.11  on 466  degrees of freedom
Residual deviance: 364.18  on 464  degrees of freedom
AIC: 370.18

Number of Fisher Scoring iterations: 5
```

```
logisticPseudoR2s(burnoutModel.1)
```

```
Pseudo R^2 for logistic regression
Hosmer and Lemeshow R^2   0.313
Cox and Snell R^2         0.299
Nagelkerke R^2            0.441
```

```
exp(burnoutModel.1$coefficients)
```

```
(Intercept)         loc        cope
 0.01128261  1.06298389  1.08623164
```

```
exp(confint(burnoutModel.1))
```

```
                 2.5 %     97.5 %
(Intercept) 0.005160721 0.02292526
loc         1.041229885 1.08691181
cope        1.067210914 1.10722003
```

```
summary(burnoutModel.2)
```

```
Call:
glm(formula = burnout ~ loc + cope + teaching + research + pastoral,
    family = binomial(), data = burnoutData)

Deviance Residuals:
     Min        1Q    Median        3Q       Max
-2.41592  -0.48290  -0.28690   0.02966   2.63636

Coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept) -4.43993    1.08565  -4.090 4.32e-05 ***
loc          0.11079    0.01494   7.414 1.23e-13 ***
cope         0.14234    0.01639   8.684  < 2e-16 ***
teaching    -0.11216    0.01977  -5.673 1.40e-08 ***
research     0.01931    0.01036   1.863 0.062421 .
pastoral     0.04517    0.01310   3.449 0.000563 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 530.11  on 466  degrees of freedom
Residual deviance: 321.20  on 461  degrees of freedom
AIC: 333.2

Number of Fisher Scoring iterations: 6
```

```
modelChi; chidf; chisq.prob
```

```
[1] 208.9086
[1] 5
[1] 0
```

```
logisticPseudoR2s(burnoutModel.2)
```

```
Pseudo R^2 for logistic regression
Hosmer and Lemeshow R^2   0.394
Cox and Snell R^2         0.361
```

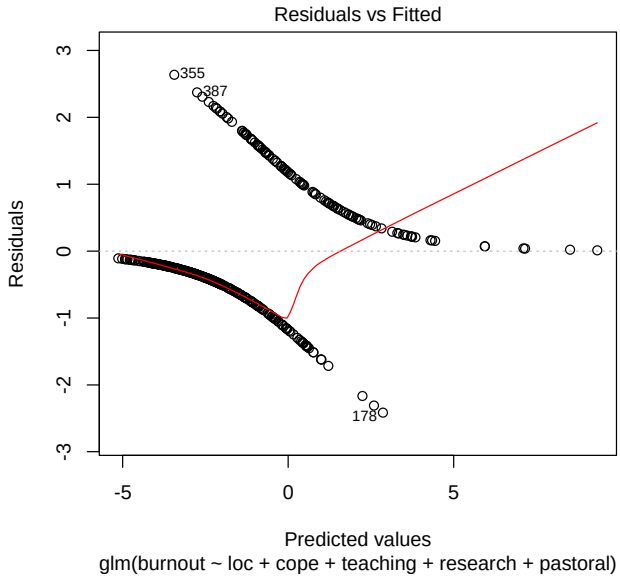
```
Nagelkerke R^2            0.531
```

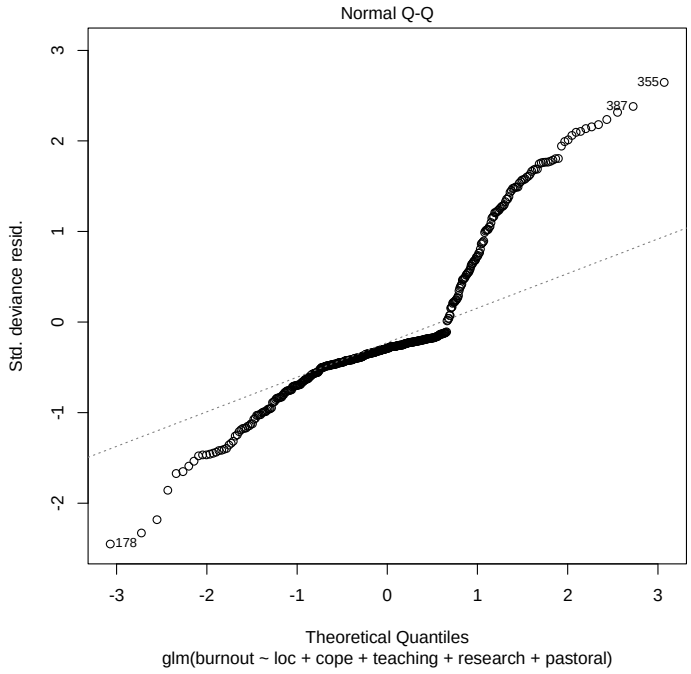
```
exp(burnoutModel.2$coefficients)
```

```
(Intercept)    loc          cope       teaching    research    pastoral
 0.01179680  1.11715594  1.15296414  0.89389904  1.01949919  1.04620942
```

```
exp(confint(burnoutModel.2))
```

```
                2.5 %       97.5 %
(Intercept) 0.001317788 0.09419003
loc         1.086274965 1.15212014
cope        1.118430575 1.19286786
teaching    0.858532732 0.92793154
research    0.999115252 1.04068582
pastoral    1.020119629 1.07403586
```





7. What analysis has been carried out?
    a. Simple regression.
    b. Hierarchical multiple regression.*
    c. Factor analysis.
    d. Reliability analysis.
8. How much variance in burnout does the final model explain?
    a. 3.61–5.31%
    b. 36.1–53.1% *
    c. 0.361–0.531%
    d. 31.3%
9. What does the normal Q-Q plot show?
    a. That the data are not normally distributed.*
    b. Homoscedasticity of errors only.
    c. Independence of errors and homoscedasticity.
    d. Heteroscedasticity and independence of errors.

Chapter 8

1. 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. The Wald statistic is analogous to the *t*-statistic in regression.
    d. The Wald statistic has a *t*-distribution.*
2. 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.

Chapter 9

1. A psychologist was interested in whether there was a gender difference in the use of email. She hypothesized 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?

```
 Welch Two Sample t-test

data:  Time Using Email
t = -1.895, df = 7.177, p-value (two-tailed) = 0.099
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -60.52295 6.52295
```

   a. Females spent significantly longer using email than males, $t(7.18) =$
   b. -1.90, $p < .05$.*
   c. Females spent significantly longer using email than males, $t(14) =$
   d. -1.90, $p < .05$.
   e. Females and males did not significantly differ in the time spent using email, $t(7.18) = -1.89$, *ns*.
   f. Females and males did not significantly differ in the time spent using email, $t(7.18) = -1.90$, *ns*.

2. 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.*

3. 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.

4. 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.
5. A researcher measured the same group of people's physiological reactions while watching horror films and compared them to when watching erotic films. The resulting data were normally distributed. What test should be used to analyse the data?
    a. Independent *t*-test.
    b. Dependent (related) *t*-test.*
    c. Mann–Whitney test.
    d. Wilcoxon signed-rank test.

Chapter 10

1. A researcher measured people's physiological reactions while watching horror films and compared them to when watching erotic films and a documentary about wildlife. Different people viewed each type of film. The resulting data were normally distributed and the variances across groups were similar. What test should be used to analyse the data?
    a. Independent analysis of variance.*
    b. Repeated measures analysis of variance.
    c. Kruskal–Wallis test.
    d. Friedman's ANOVA.

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 and 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 the all activities and book and exercises groups would perform better than the book group on a subsequent test, but that the book and exercises group would be worse than the all activities group . Which coding scheme would test these hypotheses in a set of planned comparisons?

a.

	Contrast 1	Contrast 2
Book	0	0
Book and Exercises	1	1
All Activities	1	–1

b.*

	Contrast 1	Contrast 2
Book	–2	0
Book and Exercises	1	1
All Activities	1	–1

c.

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

d.

	Contrast 1	Contrast 2
Book	2	0
Book and Exercises	–1	–1
All Activities	–1	–1

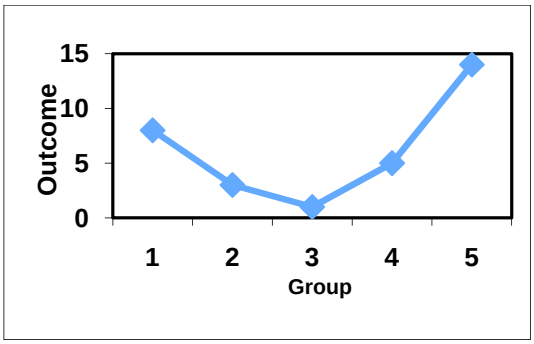
3. A Bonferroni correction is when:
    a. You apply a criterion for significance based on the usual criterion for significance (.05) divided by the number of tests performed.*
    b. You divide the *F*-ratio by the number of tests performed.
    c. The degrees of freedom are corrected to make the *F*-ratio less significant.
    d. The error in the model is adjusted for the number of tests performed.

4. 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 was recorded (although bear in mind only the treatment group actually got any treatment during this time). The **R** output is below. Based on this output, what should the researcher conclude?

```
Levene's Test for Homogeneity of Variance (center = "median")
       Df F value Pr(>F)
group   2  4.246  0.020
       45


                    Df   Sum Sq    Mean Sq  F value  Pr(>F)
group                2   529.437   264.719   5.110   .010
Residuals           45   2331.135  51.803


One-way analysis of means (not assuming equal variances)

data:  tumour and usage
F = 4.345, num df = 2.00, denom df = 26.436, p-value = .023
```

    a. The treatment groups did not have a significant effect on the change in depression levels, *F*(2, 26.44) = 4.35.
    b. The treatment groups had a significant effect on the change in depression levels, *F*(2, 26.44) = 4.35.*
    c. The treatment groups had a significant 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.

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



   a. Linear.
   b. Quadratic.*
   c. Cubic.
   d. Quartic.

6. The student welfare office was interested in trying to enhance students' exam performance by investigating the effects of various interventions. They took five groups of students before their Research Methods II (RMII) exams and gave them one of five interventions: a control group just sat in a room contemplating the task ahead; the second group had a yoga class to relax them; the third was told they would get monetary rewards contingent upon the grade they received in the exam; the fourth was given beta-blockers to calm their nerves; and the fifth was encouraged to sit around winding each other up about how much revision they had/hadn't done (a bit like what usually happens). The final percentage obtained in the exam was the dependent variable. The student welfare office made four predictions: (1) all interventions should be different than the control; (2) yoga, bribery and beta-blockers should lead to higher exam scores than panic; (3) yoga and bribery should have different effects than the beta-blocker drugs; and (4) yoga and bribery should also differ. Which of the following planned contrasts (with the appropriate group codings) are correct to test these hypotheses?

a.

	Contrast 1	Contrast 2	Contrast 3	Contrast 4
Control	–4	0	0	3
Yoga	0	1	1	–1
Beta-blockers	0	1	–2	0
Bribes	0	1	1	1
You're all going to fail	0	–3	0	0

b.

	Contrast 1	Contrast 2	Contrast 3	Contrast 4
Control	–1	0	0	0
Yoga	1	1	1	–1
Beta-blockers	1	1	–1	0
Bribes	1	1	1	1
You're all going to fail	1	–1	0	0

c.*

	Contrast 1	Contrast 2	Contrast 3	Contrast 4
Control	–4	0	0	0
Yoga	1	1	1	–1
Beta-blockers	1	1	–2	0
Bribes	1	1	1	1
You're all going to fail	1	–3	0	0

d.

	Contrast 1	Contrast 2	Contrast 3	Contrast 4
Control	–4	1	1	1
Yoga	1	1	1	–4
Beta-blockers	1	1	–4	1
Bribes	1	1	1	1
You're all going to fail	1	–4	1	1

Chapter 11

1. 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 grade of exam they were taking (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.

2. The next part of the **R** output for the example in the previous question is given below. Which of the following statements best reflects what the effect of **INSTRU** in the table tells us?

```
Response: ANXIETY
             Sum Sq     Df    F value    Pr(>F)
(Intercept)  32903.788  1     197.594      .000 ***
GRADE        907.833    1     5.452        .023 *
INSTRU       6351.708   2     19.072       .000 ***
Residuals    9325.228   56
```

    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.

3. Use the table of means and the **R** output below for the example used in the previous two questions to decide which of the following statements best reflects what these tables tell us.

INSTRU	Mean (SE)

Guitar	72.633 (3.066)
Piano	85.852 (2.887)
Drums	98.225 (2.761)

```
       Simultaneous Confidence Intervals

Multiple Comparisons of Means: Tukey Contrasts

95% family-wise confidence level

Linear Hypotheses:
                       Estimate lwr     upr
Drums - Guitar == 0    1.7857   15.355  35.830
Drums - Piano  == 0    2.2249   2.527   22.219
Piano - Guitar == 0    0.4392   2.804   23.634
```

a. Guitarists were significantly less anxious than drummers, but were about as anxious as pianists, and drummers were about as anxious as pianists.

b. Guitarists were significantly less anxious than pianists and drummers, and drummers were significantly less anxious than pianists.

c. Guitarists, drummers and pianists were all about equally anxious.

d. Guitarists were significantly less anxious than pianists and drummers, and drummers were significantly more anxious than pianists.*

A psychologist was interested in the effects of different fear information in children's beliefs about an animal. Three groups of children were shown a picture of an animal that they had never seen before (a quoll). Then one group was told a negative story (in which the quoll is described as a vicious, disease-ridden, bundle of nastiness that eats children's brains), one group a positive story (in which the quoll is described as a harmless, docile creature that likes nothing more than to be stroked), and a final group weren't told a story at all. After the story children rated how scared they would be if they met a quoll, on a scale ranging from 1 (not at all scared) to 5 (very scared indeed). To control for the natural anxiousness of each child, a questionnaire measure of trait anxiety was given to the children and used in the analysis. The (edited) **R** output is below. The next two questions relate to this output.

```
Response: Fear of Animal
                        Sum Sq  Df   F value    Pr(>F)
(Intercept)             96.249   1   109.141    .000 ***
Natural Fear Level      4.924    1   5.579      .022 *
Type of Information     13.567   2   7.685      .001 **
Residuals               49.426   56

: Type of Information
: Positive
       mean   SE.mean
       2.594  .219
------------------------
: Negative
       mean   SE.mean
       3.658      .211
------------------------
: None
       mean   SE.mean
       2.697      .215
-------------------------
```

```
Simultaneous Confidence Intervals

Multiple Comparisons of Means: Tukey Contrasts

Fit: aov(formula = libido ~ partnerLibido + dose, data = viagraData)

Quantile = 2.4856
95% family-wise confidence level

Linear Hypotheses:
                           Estimate   lwr     upr
Positive - None     == 0  -0.103   -0.880    .675
Negative - None     == 0   0.961    0.225   1.697
Negative - Positive == 0   1.064    0.306   1.823
```

4. What analysis has been used?
    a. Analysis of covariance.*
    b. Independent analysis of variance.
    c. Repeated measures analysis of variance.
    d. Mixed analysis of variance.
    e. Factor analysis.

5. Which of the following statements best reflects what the effect of 'Natural Fear Level' in the table tells us?
    a. The child's natural level of fear had a significant relationship with their fear beliefs about the animals.*
    b. The child's natural level of fear did not have a significant relationship with their fear beliefs about the animals.
    c. The type of information given to the children had a significant relationship with the child's natural level of fear.
    d. The type of information given to the children did not have a significant relationship with the child's natural level of fear.
    e. Natural fear levels were significantly different in the groups of children.

Chapter 12

1. How many dependent variables does a two-way ANOVA have?
    a. One.*
    b. Two.
    c. Three.
    d. Four.

Chapter 13

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. 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. 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.

Chapter 14

1. Field and 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'. Each child received all three types of information about different animals. The gender of the child was also recorded. 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 (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). How did they analyse their data?
    a. One-way independent ANOVA.
    b. One-way repeated measures ANOVA?.
    c. Two-way mixed ANOVA.*
    d. Two-way independent ANOVA.

2. 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'. The gender of the child was also recorded. 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). The output of their analysis is below.

```
$ANOVA
                Effect   DFn DFd     SSn         SSd         F          p           p<.05
1            INFOTYPE     2  82     9.177       4.588     7.283       .001          **
2       INFOTYPE:GENDER   2  82      .599        .299      .623        -


$`Sphericity Corrections`
                Effect       GGe     p[GG]  p[GG]<.05  HFe        p[HF]          p[HF]<.05
3            INFOTYPE    7.283    .001      *          7.283      .001             **
4       INFOTYPE:GENDER   0.475    .618      -          0.475      .623*            -
```

3. Based on the above output, what analysis has been done?
    a. A two-way mixed ANOVA.*
    b. A three-way mixed ANOVA.
    c. A two-way repeated measures ANOVA.
    d. A two-way independent ANOVA.

4. A researcher tested 40 adults. Each adult had to rate their mood after listening to a tape of people being sick, and then again after a tape of people laughing. What experimental design has been used?
    a. A repeated measures design.*
    b. A matched design.

c. A mixed design.

d. A between-subject design.

An experiment was conducted to see how people with eating disorders differ in their need to exert control in different domains. Participants were classified as not having an eating disorder (control), as having anorexia nervosa (anorexic), or as having bulimia nervosa (bulimia). Each participant underwent an experiment that indicated how much they felt the need to exert control in three domains: eating, friendships and the physical world (this final category was a control domain in which the need to have control over things like gravity or the weather was assessed). So all participants gave three responses in the form of a mean reaction time; a low reaction time meant that the person did feel the need to exert control in that domain. The variables have been labelled as **group** (control, anorexic, or bulimic) and **domain** (food, friends or physics). The **R** output from an analysis is shown below and the next two questions relate to this output.

```
$ANOVA
          Effect  DFn DFd  SSn          SSd          F         p     p<.05
       (Intercept) 1   27   7383094.090  98210.579  2029.756  .000    ***
         GROUP     2   27   6795.729     98210.579  0.934     .405
         DOMAIN    2   54   67459.951    227046.533 8.022     .001    **
  DOMAIN:GROUP     4   54   55061.976    227046.533 3.274     .018    *


$`Mauchly's Test for Sphericity`
 Effect       W     p        p<.05
 DOMAIN     .711   .012        *

$`Sphericity Corrections`
            Effect         GGe   p[GG] p[GG]<.05  HFe    p[HF] p[HF]<.05
            DOMAIN         8.022 .002   **        8.022  .002     **
            GROUP          .934  .405             .934   .405
            DOMAIN:GROUP   3.274 .029   *         3.274  .023     *
```

5. What analysis has been conducted?

   a. Two-way repeated measures ANOVA.

   b. Three-way independent ANOVA.

   c. Two-way mixed ANOVA.*

   d. Analysis of covariance.

6. What can we conclude about the main effect of the **group** variable?

   a. People with eating disorders need to exert more control over different domains of their life, $F(2, 27) = 0.93$, $p < .05$.

   b. When ignoring the type of domain, people who differ with regard to eating disorders did not significantly differ in their need to exert control, $F(2, 27) = 0.93$, $p > .05$.*

c. People with eating disorders significantly differ in their need to exert control over food, $F(2, 27) = 0.93$, $p > .05$
d. People with eating disorders need to exert significantly more control over different domains of their life than people without eating disorders, $F(1, 27) = 2029.76$, $p < .001$.

Chapter 15

1. A psychologist was interested in whether there was a gender difference in the use of email. She hypothesized 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). How should she analyse the differences in males and females?
    a. Paired *t*-test.
    b. Wilcoxon rank-sum test.*
    c. Wilcoxon signed-rank test.
    d. Independent *t*-test.

2. A researcher measured people's physiological reactions to horror films. He split the data into two groups: males and females. The resulting data were significantly skewed and men and women had equal variances. What test should be used to analyse the data?
    a. Independent *t*-test.
    b. Dependent (related) *t*-test.
    c. Wilcoxon rank-sum test.*
    d. Wilcoxon signed-rank test.
3. A researcher measured people's physiological reactions while watching horror films and compared them to when watching erotic films and a documentary about wildlife. Different people viewed each type of film. The resulting data were skewed. What test should be used to analyse the data?
    a. Independent analysis of variance.
    b. Repeated measures analysis of variance.
    c. Kruskal–Wallis test.*
    d. Friedman's ANOVA.

Chapter 16

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.

1. What analysis should be done to see if the mood inductions had an effect on responses to these nine items?
    a. Factor analysis.
    b. MANOVA.*
    c. Repeated measures ANOVA.
    d. Mixed ANOVA.
2. Part of the (edited) output is shown below. Which statement best sums up this part of the output?

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

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
GROUP	2	1.351	.676	1.380	.259
Residuals	66	32.301	.489		

I love the pretty flowers:

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
GROUP	2	3.816	1.908	1.684	.194
Residuals	66	74.793	1.133		

I could never touch a dead body:

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
GROUP	2	3.455	1.728	2.524	.088
Residuals	66	45.182	.685		

I would never eat cat food:

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
GROUP	2	12.710	6.355	9.098	.000***
Residuals	66	46.101	.699		

If someone served me monkey brain soup I would vomit:

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
GROUP	2	3.746	1.873	2.322	.106
Residuals	66	53.239	.807		

I feel fed up:

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
GROUP	2	5.594	2.797	2.739	.072
Residuals	66	67.391	1.021		

Bodily fluids are nasty:

	Df	Sum Sq	Mean Sq	F value	Pr(>F)

```
GROUP        2     3.712    1.856    3.856   .026*
Residuals   66    31.766    .481
---
```

I could not drink from a glass that I have used to catch a spider:

```
            Df    Sum Sq    Mean Sq  F value   Pr(>F)
GROUP       2      .989     .494       .271    .764
Residuals   66   120.489   1.826
---
```

I am a worthless piece of scum:

```
            Df    Sum Sq   Mean Sq  F value  Pr(>F)
GROUP        2    2.923    1.461    2.253   .113
Residuals   66   42.816     .649
```

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 cat food', and 'Bodily fluids are nasty'.*

c. There were significant differences between the mood induction conditions on four items: 'I would never eat cat food', '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 nine items.

Chapter 17

1. Varimax rotation should be used when:
    a. You believe that the underlying factors will be correlated.
    b. You believe that the underlying factors are non-orthogonal.
    c. You believe that the underlying factors are independent.*
    d. Kaiser's criterion is met.
2. Oblique rotation should be used when:
    a. You believe that the underlying factors will be correlated.*
    b. You believe that the underlying factors are orthogonal.
    c. You believe that the underlying factors are independent.
    d. Kaiser's criterion is met.
3. 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 .7.
4. What does the following output from a factor analysis tell us?

Bartlett's Test

```
R was not square, finding R from data
$chisq
[1] 402.652

$p.value
[1] 0

$df
[1] 153
```

KMO

```
$overall
[1] 0.702
```

    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 greater than zero.*
    d. The sample size is adequate, but the correlations in the correlation matrix are not large enough.

5. Marvin Zuckerman's work on dimensions of sensation seeking reveals four dimensions to this trait: (1) thrill and adventure seeking (e.g. engaging in risky sports and activities); (2) experience seeking (e.g. travelling to exotic locations, experimenting with drugs, listening to exciting music); (3) disinhibition (e.g. going to wild parties, engaging in sexual activity with strangers); and (4) susceptibility to boredom (e.g. being easily bored by predictable experiences and people). These dimensions are *theoretically independent*. A researcher was interested in designing a new questionnaire to measure sensation seeking. A 16-item questionnaire using a 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neither, 4 = agree, 5 = strongly agree) was devised and given to 750 people. The questionnaire is shown below. The next three questions relate to this example.

SD = Strongly Disagree, D = Disagree, N = Neither, A = Agree, SA = Strongly Agree

		SD	D	N	A	SA
1	I drive too fast	☐	☐	☐	☐	☐
2	Pink Floyd are the greatest band ever ... man!	☐	☐	☐	☐	☐
3	I find people predictable	☐	☐	☐	☐	☐
4	I get off my nut on drugs all of the time	☐	☐	☐	☐	☐
5	People bore me (especially lecturers)	☐	☐	☐	☐	☐
6	I don't like to stray too far from home	☐	☐	☐	☐	☐
7	I never dance naked on tables at parties	☐	☐	☐	☐	☐
8	I hate the idea of bungee jumping	☐	☐	☐	☐	☐
9	I love to go to parties and drink until I'm lying in a puddle of my own sick	☐	☐	☐	☐	☐
10	I constantly get arrested for showing my backside in public	☐	☐	☐	☐	☐
11	This exam bores me so much I might just have to walk out	☐	☐	☐	☐	☐

12 I would like to jump off a cliff	☐	☐	☐	☐	☐
13 I enjoy travelling	☐	☐	☐	☐	☐
14 Life is a mundane slog of tedium to me	☐	☐	☐	☐	☐
15 If I see a stranger I want to have sex with them	☐	☐	☐	☐	☐
16 I would love to do a parachute jump	☐	☐	☐	☐	☐

Based on the **R** output below, which relates to the analysis of the sensation-seeking questionnaire, what could you conclude?

Bartlett's Test

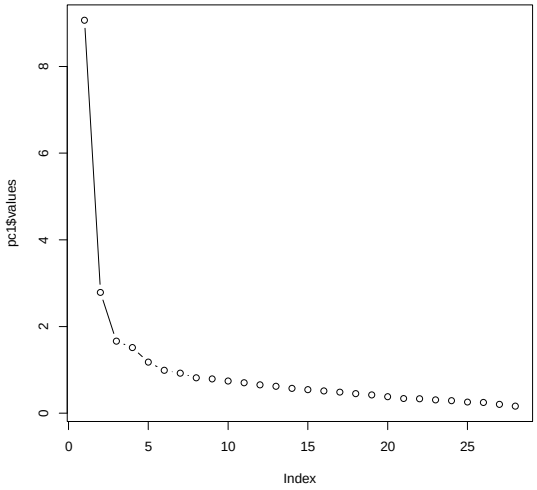
```
R was not square, finding R from data
$chisq
[1] 6467.251

$p.value
[1] 0

$df
[1] 120
```

KMO

```
$overall
[1] .681
```

a. The analysis has not been conducted on an adequately sized sample.
b. It's unclear whether the sample size is adequate, but there is multicollinearity in the data.
c. The analysis has been conducted on an adequately sized sample.*
d. There is singularity in the data.

6. Based on the scree plot below, how many factors should be extracted?



a. 2

b. 3

c. 4

d. 3 or 5*

Chapter 18

1. 933 people were asked what their favourite type of TV programme was: news, documentary, soap or sports. They could only choose one answer. As such, the researcher had the number of people who chose each category of programme. How should she analyse these data?
    a. Chi-square test.*
    b. *t*-test.
    c. One-way analysis of variance.
    d. Regression.

933 people were asked which type of programme they prefer to watch on television. Results are below.

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

2. Based on the data above, what are the odds of being a man if you prefer to watch sport?
    a. 0.47
    b. 0.14
    c. 0.41
    d. 2.13*

Chapter 19

1. A researcher was interested in the effects of information about exercises that relieve back pain delivered in two different ways by doctors. Doctors were recruited from different hospitals and each gave several patients the information. How many levels are there in this hierarchical data structure?
    a. 1
    b. 2
    c. 3*
    d. 4
2. A researcher had data collected at several schools measuring children's emotional intelligence, age, and academic performance. Which analysis should he perform to test whether academic performance is predicted by emotional intelligence when controlling for age?
    a. Multilevel model*
    b. Multiple regression.
    c. Analysis of covariance.
    d. Discriminant function analysis.
3. In a multilevel model in which an outcome was measured in children from different classrooms, a large intraclass correlation would imply that:
    a. Children within a particular class behaved very differently
    b. The outcome measure varied a lot across children within a classroom.
    c. The outcome variable varied very little across children from different classrooms.
    d. Children in different classes behaved very differently.*
4. Missing data pose the least of a problem for:
    a. Analysis of variance.
    b. Multiple regression.
    c. Principal component analysis.
    d. Multilevel linear models.*
5. In the context of multilevel models what do we mean by a fixed regression coefficient?
    a. A regression coefficient that is assumed to be the same in the population and the sample.
    b. A regression coefficient that is stable across different samples.

c. A regression coefficient that is assumed not to vary across contexts.*

d. A regression coefficient that is always a fixed value and does not need to be estimated.

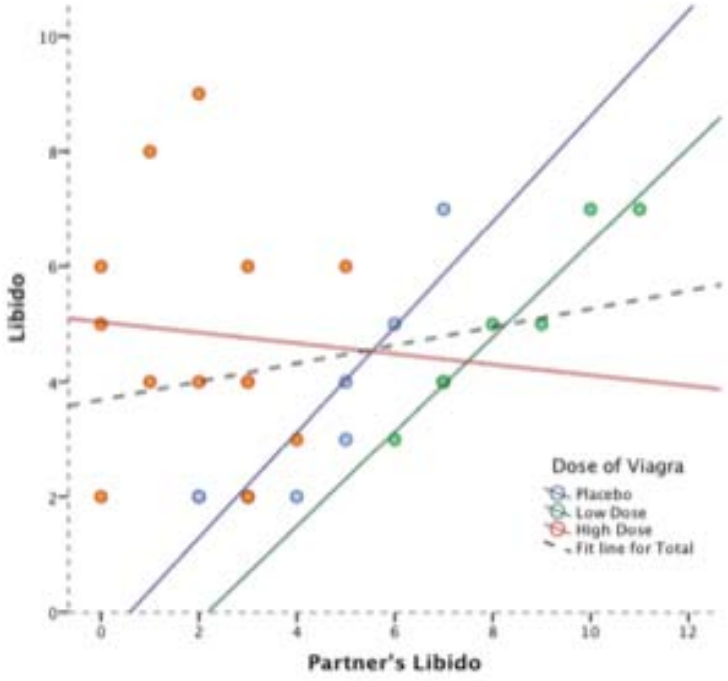
6. Which of the following descriptions best applies to the graph below?:

a. Fixed slopes, fixed intercepts.

b. Fixed slopes, random intercepts.

c. Random slopes, fixed intercepts.

d. Random slopes, random intercepts.*



7. Why does it matter that data are hierarchical (or not)?

a. Because the contextual variables in the hierarchy introduce dependency in the data*

b. Because if the data are hierarchical the residuals will be uncorrelated.

c. Because if the data are hierarchical, then missing data can be problematic.

d. Because if the data are hierarchical, then we must treat all variables as fixed effects.

8. The matrix below describes what kind of covariance structure in a multilevel model?
    a. Variance components.
    b. Diagonal.*
    c. AR(1).
    d. Unstructured.

$$\begin{pmatrix} \sigma_1^2 & 0 & 0 & 0 \\ 0 & \sigma_1^2 & 0 & 0 \\ 0 & 0 & \sigma_1^2 & 0 \\ 0 & 0 & 0 & \sigma_1^2 \end{pmatrix}$$

9. The matrix below describes what kind of covariance structure in a multilevel model?
    a. Variance components.
    b. Diagonal.*
    c. AR(1).
    d. Unstructured.

$$\begin{pmatrix} \sigma_1^2 & \sigma_{21} & \sigma_{31} & \sigma_{41} \\ \sigma_{21} & \sigma_2^2 & \sigma_{32} & \sigma_{42} \\ \sigma_{31} & \sigma_{32} & \sigma_3^2 & \sigma_{43} \\ \sigma_{41} & \sigma_{42} & \sigma_{43} & \sigma_4^2 \end{pmatrix}$$

10. What is a second-order polynomial also known as?
    a. A linear trend.
    b. A cubic trend.
    c. A quartic trend.
    d. A quadratic trend.*
11. The **R** output below shows:
    a. A model that predicts quality of life after surgery from the variables **Surgery**, **Base_QoL** and the intercept, with intercepts varying across clinics.
    b. A model that predicts post-surgery quality of life from only the intercept but also allows intercepts to vary across clinics.*
    c. The summary of the model that contains both random slopes and intercepts.
    d. A baseline model that includes only the intercept.

```
Linear mixed-effects model fit by maximum likelihood
 Data: surgeryData
       AIC      BIC    logLik
  1911.473 1922.334 -952.7364

Random effects:
 Formula: ~1 | Clinic
        (Intercept) Residual
StdDev:    5.909691 7.238677

Fixed effects: Post_QoL ~ 1
               Value Std.Error  DF  t-value p-value
(Intercept) 60.08377  1.923283 266 31.24022       0

Standardized Within-Group Residuals:
       Min         Q1        Med         Q3        Max
-1.8828507 -0.7606631 -0.1378732  0.7075242  2.8607949

Number of Observations: 276
Number of Groups: 10
```