Web Page for Chapter 10

MULTIPLE CHOICE QUESTIONS–SET A

1 Speculations about the relationship between two or more variables are called:
(a) theories
(b) hypotheses
(c) principles
(d) correlations

2 When the investigator has a high expectation concerning the relationship that exists between variables, it is quite appropriate to state the hypothesis in what form?
(a) null
(b) directional
(c) non-directional
(d) alternative

3 ‘There will be no significant difference between the scores on the Morale Scale between skilled and unskilled employees’ is a hypothesis written in what form?
(a) null-directional
(b) null
(c) alternative
(d) directional

4 Which criterion does the following hypothesis most violate? ‘Courses in civics will produce better adult citizens than no courses at all’:
(a) hypotheses should be worthy of testing
(b) hypotheses should be brief
(c) hypotheses should be testable
(d) all of the above

5 The rejection of the null hypothesis when it is correct is called:
(a) a Type I error
(b) a Type II error
(c) alpha
(d) beta

6 Confidence limits are useful because they:
(a) yield the probability of making a Type I error
(b) provide a more stable test of statistical significance than the t ratio
(c) determine the range of data within certain probability limits
(d) enable inferences from sample statistics to population parameters

7 After taking a sample we say we are 88% confident that the population mean is between 106 and 122. What do we mean?
(a) the probability is .88 that the population mean lies between 106 and 122
(b) the probability is that the population mean is 114
(c) 88% of the confidence intervals calculated from sample of this size will contain the population mean
(d) (a) and (c) but not (b)

8 The probability of obtaining Z = +1.96 by chance alone on a one-tailed test is:
(a) .0150
(b) .0427
(c) .0329
(d) .0187

9 What is the probability on a two-tailed test?
(a) 1/2(one-tailed probability)
(b) 2(one-tailed probability)
(c) $\sqrt{\text{one- tailed probability}}$
(d) one-tailed probability^2

10 If the investigator obtains a statistically significant result, they can state that the results:
(a) verify the hypothesis
(b) prove the hypothesis
(c) confirm the hypothesis
(d) support the hypothesis

11 In a two-tailed test conducted at the 1% level we have rejected the null hypothesis. Which one of the following is true:
(a) The probability that the null hypothesis is false is .99
(b) If we always use the 1% level over the long run we will make the wrong decision on the null hypothesis 1% of the time.
(c) The probability we made a wrong decision on the null hypothesis is, .99.
(d) If we always use the 1% level over the long run we will make a wrong decision on the null hypothesis on 1% of those occasions when the null is true.

12 A Type II error occurs when:
(a) the null hypothesis is accepted but is false
(b) the null hypothesis is rejected and is false
(c) the null hypothesis is rejected and is true
(d) the null hypothesis is actually false

13 If employees take 2 hours to complete one widget on Monday morning, this time is:
(a) population parameter
(b) a point estimate
(c) an interval estimate
(d) none of these

14 A major car manufacturer has to recall a model from its 2008 production as a major defect has been found that did not surface in the final random inspection procedures. This is an example of:
(a) Type I error
(b) Type II error
(c) neither type of error
(d) chance variation

15 If we set alpha at .05 for a particular hypothesis test we are saying that:
(a) 5% is the risk we take of accepting a hypothesis that is true
(b) 5% is the risk we take of accepting a hypothesis that is false
(c) 5% is the risk we take of rejecting a hypothesis that is true
(d) 5% is the risk we take of rejecting a hypothesis that is false

16 Suppose a hypothesis test is being performed for a process in which a Type II error is relatively inexpensive and unimportant but a Type I error is very costly. Which alpha level would be best?
(a) .01

(b) .05
(c) .10
(d) .50

17 A one-tailed hypothesis is:
(a) non-directional
(b) missing one tail
(c) directional
(d) directionless

18 'The age of the youngest child of families in London is higher than that of those in Washington DC' is best described as:
(a) a non-directional hypothesis
(b) an hypothesis
(c) a non-directional prediction
(d) a directional hypothesis

19 'The ages of the youngest child in families in London and in Washington DC are not significantly different'. This is an example of:
(a) an alternative hypothesis
(b) an alternate hypothesis
(c) a zero hypothesis
(d) a null hypothesis

20 If H_o is rejected when it is in fact true, we have:
(a) a Type II error
(b) a Type I error
(c) a standard error
(d) a type of error

21 The 95% levels of confidence lie between:
(a) $\pm$ .95Z
(b) $\pm$ .05Z
(c) $\pm$ 1.96Z
(d) $\pm$ 2.58Z

MULTIPLE CHOICE QUESTIONS – SET B

1 The significance value calculated by SPSS tests can be found in the output data under the heading 'sig', but the name for it in statistics is the ………value –
(a) N
(b) p
(c) M
(d) Σ

2 If the SPSS output data informs us that p = 6%, i.e. .06 this means:
(a) There is a 6% chance the null hypothesis is true and so we accept it.
(b) There is a 6% chance the null hypothesis is false and so we reject it.
(c) There is a 4% chance the null hypothesis is true and so we accept it.
(d) There is a 10% chance the null hypothesis is true and so we reject it.

3 In *Qu. 2* above which conclusion would we draw if $p > .05$?
(a) reject null hypothesis
(b) do not reject null hypothesis
(c) do not reject alternative hypothesis
(d) reject the alternate hypothesis

4 If the p value is equal to .03 this means that:
(a) 3 times in 100 the alternative hypothesis is accepted when it is false.
(b) 3 times in 100 the alternative hypothesis is accepted when it is true.
(c) 3 times in 100 the null hypothesis is accepted when it is false.
(d) 97 times in 100 the alternative hypothesis is accepted when it is false.

5 When deciding whether a research hypothesis is supported or not, look in the printout:
(a) find the p value; if it is more than .05 then the alternate hypothesis is supported
(b) find the p value; if it is less than .05 then the null hypothesis is supported
(c) find the p value; if it is more than .05 then the null hypothesis is rejected.
(d) find the p value; if it is less than .05 then the alternate hypothesis is supported

6 If the output indicates that $p < .05$, then the result is described as being:
(a) non-significant
(b) not significant
(c) insignificant
(d) significant

7 The research hypothesis is supported if SPSS output data set for a standard level of .05 show a calculated significance level (p) which is:
(a) .049
(b) more than 0.05
(c) .50
(d) 5.00

8 A CEO is of the opinion that contrary to common belief, increasing pay will decrease employees' job satisfaction. What is the DV in this study?
(a) pay
(b) CEO
(c) job satisfaction
(d) employees

9 With reference to *Qu. 8* above, what type of hypothesis would be appropriate for this study?
(a) alternative
(b) directional
(c) non-directional
(d) Type I

10 A hypothesis that tested whether the mean weekly income of a group of employees at EFG company is less than $650 would be:
(a) a two-tailed test
(b) a fish-tailed test
(c) a one-tailed test
(d) a null-tailed test

11 A Type I error is symbolized by:
(a) p
(b) alpha
(c) beta
(d) sigma

ADDITIONAL QUESTIONS/PROBLEMS

1 One investigator typically sets alpha at 10% whereas another sets it at 5%. In the long run which one makes the more Type I errors?

2 Construct operational alternative and null hypotheses for the following problems:
(a) Does supervisor feedback cause changes in employee performance?
(b) Does group decision-making lead to less risk taking?

3 Formulate null hypotheses for the following alternative hypotheses:
(a) That there is a significant difference in the mean score on Raven's Progressive matrices between male university students and male TAFE students.
(b) That there is a significant relationship between scores on Witkin's Embedded Figures Test and extroversion as measured by the EPI in MBA graduates.
(c) Assuming the relationship in (b) above was found to be statistically significant, make a statement about the implications for the:
(i) null hypothesis,
(ii) alternative hypothesis.

4 Complete the following table:

p	Two-tailed	One-tailed
.05	a	1.65
.01	2.58	b
		Assume N = 1,000

5 What are the advantages and disadvantages of:
(a) one-tailed tests, and
(b) two-tailed tests?

6 A researcher predicts that a treatment will lower scores. If a one-tail test is used, will the critical region be in the right-hand or left-hand tail as you look at it?

7 Why should the choice of a one- or two-tailed test be made before the data are gathered?

8 A sauce manufacturer wants to decide whether to produce a new extra spicy brand. Marketing research by telephone survey of 6,000 households found that it would be bought by 3,535 of them. What is the 95% confidence interval?

9 Total sales to customers are claimed by a company to amount to $1,625,555 over the year. It has been verified within a small margin of error that the number of sales processed during the year is 13,120. A random sample of 150 invoices shows an average value of sales per order of $119 with a sample standard deviation of $28. Is the company's claim reasonable?.

10 The total R and D budget for Peck Ping in a certain year is $10 million: 215 R and D projects are being undertaken. A random sample of 60 projects has a mean cost of $52,670 and SD = $30,075. Is there evidence that the budget will be exceeded?

11 A TV documentary claims that women in the country are 10 kg overweight on average. To test this claim 180 randomly selected women were weighed and found to be 12.4 kg overweight with a SD = 2.7 kg. At the 1% level is there any reason to doubt the validity of the claimed 10 kg value?

12 Given a sample mean of 83 and SD = 12.5, with a sample size of 122, test the null hypothesis that the population mean is 70. Use the 5% level.

13 A real estate manager took a random sample of 144 homes in a prestigious area of Houston and found an average appraised market value of \$780,000 with an SD = \$49,000. Test the hypothesis that for all homes in the area the mean appraised value is \$825,000 at the 5% level.

14 The police chief has instituted a crackdown on drug dealers in the city: 750 of the 12,368 known drug dealers have been caught. The mean dollar value of drugs found on these 750 dealers is \$250,000. The SD was \$41,000. Construct a 95% confidence interval for the mean dollar value of drugs possessed by the city's drug dealers.

15 The average age for employees in a large national organization is 39.7 years with SD = 11.8. A branch manager noticed that his regional staff of 100 had an average age of 51.4.
(a) How likely is it to obtain a staff complement this old or older by chance?
(b) Is it reasonable to conclude that this staff complement is not representative of the organisation's employees as a whole?

16 After a long study of pilot performance on flight simulators the airline management know that reaction time to an overhead emergency indicator is normally distributed with M = 200 ms and SD = 20 ms. The psychologist in charge wants to test the indicator at eye level to see if this placing has any effect on reaction time. A random sample of 100 pilots is tested.
(a) identify the IV and DV
(b) state the null hypothesis
(c) if the mean reaction time is 195 ms what decision is made about the null hypothesis?
(d) if the sample had been 200 what decision is made?; explain why this is different from that in (c)

17 The Department of Taxation sampled 200 tax returns and found a sample tax refund amounted to \$425.39 with an SD = \$107.10.
(a) estimate the population mean tax refund and SD
(b) using the estimates above construct an interval in which the population mean is 95% certain to fall

18 An automobile manufacturer claims that a particular model will give 28 miles to the gallon. A consumer protection agency uses a sample of 100 cars of this model and finds the mean to be 26.8 miles per gallon. The SD is known to be 5 miles per gallon. Can we reasonably expect within 2 SE's that we could select such a sample if indeed the population mean is actually 28 miles per gallon.

19 The average commission charged by brokerage firms for shares is \$144 with SD = \$52. A random sample of 121 trades I made last year showed an average commission of \$151. At the .05 level can I conclude that I paid higher commission than the industry average. Should I change to another broker.

20 For a population of 20 year olds M = 80 with SD = 10 on a standardized problem-solving test. To test the effectiveness of a problem-solving training program me a random sample of 100 20-year-olds is trained then given the test. Their M = 84.44. Test using 5% level and make a conclusion about the null hypothesis.

21 Why must the sum of the probabilities of the null and research hypotheses always equal 1?

22 Is a smaller critical value required for the rejecting of the null hypothesis under a one-or two-tailed test.

23 A new product is tested on a random sample of 90. A total of 63 say they will buy the new product. A point estimate of the population proportion who will buy the product is 63/90 or .7 (70%). What is the standard error of a proportion? What are the 95% confidence limits?

24 A radio station wants to determine what percentage of the population listen to a particular programme. A random sample of 500 homes reveals that 275 tune in. What is the 95% confidence interval?

GROUP/CLASS ACTIVITIES

1 In groups, consider the following examples in terms of the five criteria for a good hypothesis. Look at each hypothesis and say whether it satisfies all the criteria. If it does not, say why not. Share your answers.
   (a) Among 18-year-old male apprentices, introverts, as measured by the Eysenck Personality Inventory, will gain significantly higher scores on a vigilance task involving the erasing of every V on a typescript than extroverts.
   (b) Errors made by data input personnel depends on their level of skill.
   (c) The introduction of politics into the curriculum of secondary schools will produce better citizens.
   (d) Anxious interviewees do badly in job interviews.
   (e) Lubi oils provide better engine protection than Oosy oils.

2 In groups, define the variables underlined in the following and then share and comment on your group products:
   (a) Managers who *suffer stress* are *less person centred* in their *leadership role* than managers who are *not so stressed.*
   (b) *Stimulation at home advances language development* in *young children.*
   (c) *Employees* with *substance abuse problems* tend to come from *disrupted home environments.*

3 In groups, explain (a) why knowledge is advanced if a hypothesis cannot be supported, and (b) why we evaluate the null hypothesis rather than the alternative hypothesis. Share your ideas.

4 In groups, rewrite the following loose statements as operational hypotheses then compare and evaluate the group products:
   (a) Printed instructions are harder to understand than instructions in the form of drawings.
   (b) One sex will avoid walking under a ladder more than the other sex.
   (c) The presence of an audience causes people to perform poorly on a skilled task.

5 In groups, explain:
   (a) the relationship between significance level, one- and two-tailed tests and Type I and Type II errors.
   (b) the difference between a point estimate and an interval estimate
   (c) the difference between the confidence level and the confidence interval

6 In groups, formulate operational definitions of the following: quality performance; defective product; supervisory experience; morale; motivation

7 In groups, (a) explain why knowledge is advanced if a hypothesis cannot be supported, and (b) why we evaluate the null hypothesis rather than the alternative hypothesis?

8 The meaning of ‘retaining the null hypothesis’ is not exactly the opposite of ‘rejecting the null hypothesis’. Explain.

9 Within groups, state the null and alternative hypotheses and list potential problems in the experimental design for each of the following experiments:
   (a) Bill is a sports manager and is interested in knowing the effects of two pieces of gym equipment (type S and type T) on the performance of athletes. He recruits 30 male rowers and 20 female weightlifters to participate. The males were allocated type S equipment and the females type T. After two months, the performance of the rowers was tested by their coach. Bill tested the female group after three months.
   (b) The management of the largest fish farm in Thailand want to determine the best temperature for cultivating barramundi fingerlings. They use three different tanks with temperatures of 20, 25 and 30 degrees. 20 fingerlings were placed in each tank and their size and weight measured after 6 weeks.

10 Work in groups. Assume your hypothesis is concerned with the academic performance of students in your university faculty and the amount of time they spend in licensed premises (Public houses, clubs, hotels, pubs, taverns, etc.).
  (a) How would you go about drawing a systematic sample from this population? (Assume 1,000 students and you want to select 200).
  (b) List three different ways of stratifying this population.
  (c) State the null and alternate hypotheses you could use in this study.

ANSWERS TO QUESTIONS IN CHAPTER 10

Qu. 10.2 a = difference; b = relationship

Qu. 10.6

$$SE_M = \frac{1.5}{\sqrt{225}} = .196$$

The 95% confidence interval lies between 10 km per litre ±1.96(.196). This produces a 95% confidence interval 9.804 to 10.196 km per litre. Only 5% of their cars lie outside these limits.

Qu. 10.7

The standard error of the proportion is given by:

$$SE_p = \sqrt{\frac{pq}{N}} = \sqrt{\frac{.18 \times .82}{1000}} = .0120 \text{ or } 1.20\%$$

Using the sample proportion as an estimate of the population proportion we can say that we are:

68.26% certain that the true percentage of motorists whose cars went in for repair and servicing would be contained in the range 18% $\pm$ 1.20%;

95% certain that the true percentage would lie within 18% $\pm$ 1.96(1.20%); and 99% certain that it would lie within 18% $\pm$ 2.58(1.20%).

Qu. 10.8

The standard error of the proportion is:

$$SE_p = \sqrt{\frac{pq}{N}} = \sqrt{\frac{.7 \times .3}{90}}$$

= 4.8% or 65.2% – 74.8% is the range of the 95% confidence interval.

ANSWERS TO MULTIPLE CHOICE QUESTIONS – SET A.

1 (b), 2 (b), 3 (b), 4 (d), 5 (d), 6 (c), 7 (d), 8 (d), 9 (d), 10 (d), 11 (d), 12 (c), 13 (a), 14 (a), 15 (b), 16 (a), 17 (c), 18 (d), 19 (d), 20 (b), 21 (c).

ANSWERS TO MULTIPLE CHOICE QUESTIONS – SET B

1 (b), 2 (a), 3 (a), 4 (a), 5 (d), 6 (d), 7 (a), 8 (c), 9 (b), 10 (c), 11 (b)

ANSWERS TO ADDITIONAL QUESTIONS

1 The first experimenter is taking a greater risk (10%) of making a Type I error

2 Wording similar to the following:
  (a) Employees who receive structured supervisor feedback on a weekly basis produce over a four week period significantly less waste material per unit than employees not receiving such feedback. For null version include words ‘do not’ before ‘produce’.
  (b) Group decision making by the company’s managers leads to less risky decisions than their individual decisions as measured on the Risky Shift scale – the null version includes ‘does not’ before ‘leads’).

3 In both a and b delete ‘a’ and include ‘no’ before ‘significant’; c: the null hypothesis is rejected and the alternative hypothesis is supported).

4 a = 1.96; b = 2.33

5 One-tailed tests enable the null hypothesis to be rejected at a lower significance level; however, this increases the chance of rejecting a null hypothesis when it in fact true. Two-tailed tests require a higher level of significance but reduce the possibility of a Type I error.

6 Left hand.

7 If the outcome is statistically significant under a one-tailed but not a two-tailed test the investigator may be tempted to report they conducted a one-tailed test. Which test is used should be dictated by the logic of the enquiry and not by the resulting data.

8 Z = 2.07; reject null hypothesis; interest has increased.

9 Z = X – M /SEm = (119 – 123.88) / 2.2862 = – 2.13. This is significant at the 5% level. It is possible that sales have been overstated.

10 Z = X – M/SEm = (52670 – 46512)/ 3883 = 1.59 therefore retain the null hypotheses that the population mean is $10 million/215 = $46,512.

11 Z = (12.4 – 10.0)/0.20 = 12. This is well beyond the 1% level so reject null hypothesis as claim does not appear to be valid – it underestimates the overweight problem.

12 Z = 13/1.13 = 11.50; reject null hypothesis.

13 Z = (780000 – 825000) /4083.3 = –11.02; reject the null hypothesis.

14 $250,000 ± $1,496.9(1.96) = $283,329 - $226,671.

15 Z = (39.7 – 51.4) / 1.18 ; Z = –9.91; this Z has a very low probability p< .001; this group of staff is not a random sample in ter ms of age.

16 a: DV = reaction time, IV = position of indicator light; b: the position of the indicator light has no significant effect on reaction time; c: Z = –2.5 reject null hypothesis; d : Z = –3.53 reject null hypothesis – with larger N there is less sampling error.

17 (a) estimates same as sample data; b = $425.39 ± 7.57(1.96) = $440.23 – 400.55.

18 The range for 2SE is 26.80 ± 2(.5) = 25.8 to 27.80. No.

19 Z = 1.48; the upper confidence limit for the .05 level one-tailed is Z = 1.65 thus I am not being charged significantly higher.

20 SE =1; Z = 4.44/1 = 4.44; reject null hypothesis.

21 Because they must taken together, cover all potential outcomes resulting from a study.

22 Under a one-tailed test.

23 $SE_p = \frac{\sqrt{pq}}{\sqrt{n}} = \frac{.7 \times .3}{\sqrt{90}} = .048$

The 95% confidence limits are:

$.7 - (1.96 \times .048)$ to $.7 + (1.96 \times 0.048)$

or .61 to .79. This implies that we can be 95% confident that the true proportion lies between $p = .61$ and $p = .79$.

24 $\quad SEp = \dfrac{.55 \times .45}{\sqrt{\ 500}} = .022$

The confidence interval = $.055 \pm (1.96 \times .022) = .55 \pm .043$ or from .593 to .507.

The station manager can be 95% confident that between 50.7% and 59.3% listen to the programme.