PSYC2001
Practice Examination
2023

Surname: ____________________

Given Name(s): ____________________

zID: ____________________

Date: ____________________

1. What is the purpose of descriptive statistics?

a. To describe a population's characteristics.
b. To make deductions of the population using the sample statistics.
c. To describe a sample's characteristics.
d. To evaluate how accurate the sample's statistics is compared to the population statistics.

2. What is the most appropriate statement about the effect of having a larger sample?

a. It makes it harder to extrapolate the trends within the sample.
b. It leads to better estimations about the population distribution and the population mean.
c. It increases internal validity.
d. It leads to an unrepresentative depiction of the population as there is increased variance within a larger sample.

3. What is the 'central limit theorem'?

a. A specific interval holds the population mean.
b. It ensures the sample is normally distributed.
c. The gap between the population mean and the sample mean is tightened.
d. The sample will always be normally distributed as the sample size increases even if the population is not normally distributed.

4. Using the normal curve table, what is the probability of obtaining a sample mean higher than 75 knowing that its z-score of 0.5?

0.48	0.1844
0.49	0.1879
0.50	0.1915
0.51	0.1950
0.52	0.1985
0.53	0.2019

a. (0.5 - 0.1915) = 0.31
b. (1.5 - 0.433) = 0.067
c. (0.5 + 0.1915) = 0.69
d. (1.5 + 0.433) = 1.9

5. What is the z-score when the score is 32, the population mean is 40 and the standard deviation of the sample is 5?

a. -1.6
b. -5
c. 1.5
d. -1

6. Using the normal curve table, what is the probability of obtaining a sample mean between 84 and 92 if they have a z-score of -2.5 and +2.5 respectively?

2.45	0.4929
2.46	0.4931
2.47	0.4932
2.48	0.4934
2.49	0.4936
2.50	0.4938
2.51	0.4940
2.52	0.4941
2.53	0.4943

a. (0.4938 x 2) = 0.99
b. (0.4125 x 2.5) = 1.03
c. (0.4713 x 1) = 0.4713
d. (0.4938 x 2.5) = 1.2

7. The scores that students achieved on a statistics exam were normally distributed with $\sigma^2 = 81$. Obtain a 90% confidence interval for μ where n = 25 and M = 55.

a. 53.821 & 61.372
b. 48.25 & 54.55
c. 52.039 & 57.961
d. 56.05 & 63.95

8. Which of the following best describes a null hypothesis?

a. A hypothesis that states there is only a weak relationship between two variables.
b. A hypothesis that states there is a positive relationship between two variables.
c. A hypothesis that states there is a negative relationship between two variables.
d. A hypothesis that states there is no significant relationship between two variables.

9. The alternative hypothesis is true when

a. If $|z| < z_c$ in a hypothesis test
b. the result is considered "statistically significant"
c. The null hypothesis is true.
d. None of the above.

10. Which of the following best describes a Type II error in statistical hypothesis testing?

a. Failing to reject a false null hypothesis.
b. Rejecting a true null hypothesis.
c. Accepting a true alternative hypothesis.
d. Rejecting a false alternative hypothesis.

11. Which of the following statements is true regarding the effect of α on Type I and Type II errors?

a. Decreasing α will increase the likelihood of Type I errors and increase the likelihood of Type II errors.
b. Increasing α will decrease the the likelihood of Type I errors and increase the likelihood of Type II errors.
c. Increasing α will increase the likelihood of Type I errors and decrease the likelihood of Type II errors.
d. Changing α has no effect on Type I and Type II errors

12. A company implemented a new training program for 8 of its employees in the marketing department to improve their productivity and job satisfaction. The program consists of a series of workshops and coaching sessions over a 6-week period. Employee job satisfaction was measured before (Pre-test) and after (Post-test) the program using a standardized survey out of 100. The changes in scores pre and post-test are listed below.

Participant	**Post**	**Pre**
1	65	62
2	72	68
3	65	64
4	56	52
5	73	72
6	61	55
7	61	58
8	63	61

a. Carry out an appropriate analysis to test whether there is a significant improvement in the outcomes of productivity and job satisfaction.

Question 12 continues on page 5

b. The Jamovi output for the above experiment is as follows:

Paired Samples T-Test

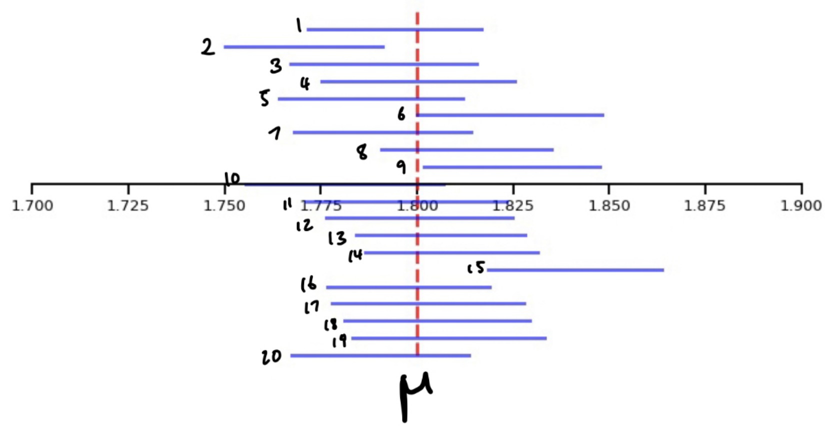
			statistic	df	p
Pre	Post	Student's t	–	7.00	0.002

Note. $H_a\ \mu_{\text{Measure 1 - Measure 2}} \neq 0$

i. What would you assume to come in the blank space next to Student's t in this case assuming that the results are the same?

ii. What does the value under "p" refer to in relation to the t-value, draw a diagram of the t distribution to support your answer. What does it allow us to conclude in this case?

13. Referring to the diagram below, in which of the following cases would the Ho: $\mu = 1.8$ be rejected? Explain why.



14. A study examined whether a new drug could reduce the fever symptom of temperature. The researchers provided one group of feverish patients with a placebo drug, and the other with the new drug. Carry out an appropriate test to evaluate the effectiveness of the drug.

Placebo	**Treatment**
38.2	38.1
38.5	37.9
38.7	37.5
38.4	38.3
37.9	37.2

15. What is the benefit of using within-subjects design over a between-subjects design?

a. It provides more accurate results as the standard deviation is smaller.
b. It requires less number of people to be recruited.
c. The standard error is reduced as there is less variability between the conditions.
d. Rank order effects are not an issue in within-subjects designs.

16. What happens when ρ is bigger than 0 in within-subjects designs?

a. The standard error is smaller in within-subjects than the standard error in between-subject designs.
b. The t-statistic for within-subject designs will be smaller.
c. The null hypothesis is easier to reject.
d. There will be a larger standard error than between-subject designs.

17. What are the five factors that affect statistical power in a research study, and how do they impact the ability to detect a significant effect?

18. What are Cohen's guidelines for effect size and how can they be used to interpret the magnitude of effects in research studies?

19. A researcher wishes to carry out a single mean t-test to compare the mean symptom scores for a group of 16 patients. She wants to detect a difference of 0.8 standard deviations or larger. What power is needed for this test?

20. An experimenter wants to test a new medication that reduces the mean blood pressure in patients with hypertension. How many participants per group will the experimenter need if she wishes to detect an effect size of at least 0.5 between groups with 90% power?

21. A researcher wishes to test whether a new teaching method improves student performance on a standardised test. She randomly assigns participants to either the new teaching method or the control group where $n_1 = n_2 = 50$. How much power will the researcher have to detect a small, medium or large effect size?

22. How does manipulating the independent variable to create a larger effect size effect statistical power?

23. What is the main difference between an exploratory test and a confirmatory test?

24. Calculate the collective error rate ie. the chance of rejecting H0 if there is an alpha of .05 and were 28 experiments completed? Write a conclusion statement about what this means.

25. Calculate a hypothesis test for when the null hypothesis states rho = 0, n = 30 and r = 0.67 at an alpha level of 0.05.

26. Calculate the power when n = 103 and with a correlation of at least ± 0.2.

27. The housing market (Y) is variable (X) to the population density. The current correlation (r) is 0.75. The average population of areas in rural NSW is 6,031, with a standard deviation of 741. The average price of a house in this area is $516,000 and standard deviation 34,400. What will be the price of a house when the population of these areas reaches 9000

End of paper

Answers & Rationales

1. **C -** *Rationale: As stated in lecture 1, slide 4.*

2. **B -** *Rationale: A larger sample size is more reflective of the population distribution, thereby leading to a sample mean that is truer to the actual population mean. Having a larger sample size can reduce variability and therefore increase internal validity but this isn't always necessarily the case. does not always increase the internal validity.*

3. **D -** *Rationale: As stated in lecture 1, slide 18*

4. **A -** *Rationale: The corresponding area under the curve for a z-score of 0.5 is 0.1915 according to the table. Thus the probability of obtaining a sample mean higher than that of 0.5 will be 50%/.5 (the positive side of the distribution) minus 0.1915 as we want to establish the remaining area (i.e. the area of a sample mean being higher than 75).*

5. **A -** *Rationale: See the z-score formula on slide 29 of lecture 2.*

6. **A -** *Rationale: The corresponding area under the curve for a z-score of 2.5 is 0.4938 according to the table. Multiply it by 2 to account for the space under -2.5 (both sides of the distribution) to get an answer of 0.99.*

7. **C -** *Rationale: The z-critical for a 90% confidence interval is 1.645 and the standard error can be calculated by taking the square root of 81 which is 9 and apply it to the formula giving an answer of 1.8. Find the upper and lower limits for μ.*

8. **D -** *Rationale: As stated in lecture 3, slide 12.*

9. **D -** *Rationale: B is incorrect as even though a result may be considered statistically significant, it doesn't mean that the alternative hypothesis is true, it only means the null hypothesis is rejected. A is incorrect* $|z| > z_c$ and the null hypothesis should be false.

10. **A -** *Rationale: As stated in lecture 4, slide 8.*

11. **C -** *Rationale: As stated in lecture 4, slide 9*

12.

a.

Step 1:
- H_o: $\mu_D = 0$
- H_1: $\mu_D \neq 0$

Step 2:
- $\alpha = 0.05$
- df = n-1 = 7
- $t_c = 2.365$

Please turn over

Participant	X_1 (Pre)	X_2 (Post)	$X_D = X_1 - X_2$	$x_D = X_D - M_D$	x^2_D
1	62	65	-3	0	0
2	68	72	-4	-1	1
3	64	65	-1	2	4
4	52	56	-4	-1	1
5	72	73	-1	2	4
6	55	61	-6	-3	9
7	58	61	-3	0	0
8	61	63	-2	1	1
∑	492	516	-24		$\sum x^2_D = 20$
Mean	61.5	64.5	$M_D = -3$		

$$s_{M_D} = \sqrt{\frac{\Sigma(X_D - M_D)^2}{n(n-1)}} = \sqrt{\frac{20}{8*7}} = 0.598 \text{ (3dp)}$$

$$t = \frac{M_D}{s_{M_D}} = \frac{-3}{0.598} = -5.02 \text{ (3dp)}$$

Reject H_0 if $|t| \geq tc$
Since $5.02 \geq 2.365$

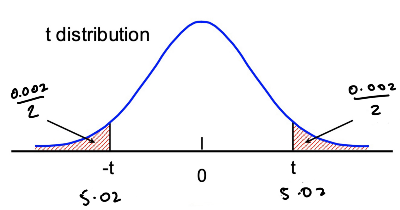
Evidence suggests, at .05 level of significance, 2-tailed, that mean job satisfaction of employees is higher in the post-test condition compared to the pre-test condition.

*You can choose either a hypothesis test or confidence interval, the solution is just for hypothesis test

b. **i.** -5.02

ii. p-value is the probability of obtaining a test statistic as deviant as the one obtained.
In this case when alpha = .05, two-tailed test of H_o: $\mu_D = 0$ where obtained t = -5.02 and p-value is .002, This means that when $\mu D = 0$ (ie H0 is true), the probability of obtaining |t| equal to or larger | 5.02 | than is .002.

Assuming an alpha of .05, since p (0.002) < 0.05 so we reject H_0.



13. We would reject case 2, 9 and 15. This is as the confidence interval does not include the null hypothesis.

14.

Step 1:

- H_o: $\mu_1 - \mu_2 = 0$
- H_1: $\mu_1 - \mu_2 \neq 0$

Step 2:

- $\alpha = 0.05$
- $df = n_1 + n_2 - 2 = 8$
- $t_c = 2.306$

Participant	**X1**	**X1 – M1**	**(X1 – M1) ^2**	**Participant**	**X2**	**X2 – M2**	**(X2 – M2) ^2**
1	38.2	-0.14	0.0196	**1**	38.1	0.3	0.09
2	38.5	0.16	0.0256	**2**	37.9	0.1	0.01
3	38.7	0.36	0.1296	**3**	37.5	-0.3	0.09
4	38.4	0.06	0.0036	**4**	38.3	0.5	0.23
5	37.9	-0.44	0.1936	**5**	37.2	-0.6	0.36
∑	191. 7	0	*0.372*	∑	189	0	*0.8*
Mean	M_1 =38.34			**Mean**	M_2= 37.8		

$$s_{M_1-M_2} = \sqrt{\frac{\Sigma(X_1-M_1)^2+\Sigma(X_2-M_2)^2}{n_1+n_2-2}\left(\frac{1}{n_1}+\frac{1}{n_2}\right)} = \sqrt{\frac{0.372+0.8}{10-2}\left(\frac{1}{5}+\frac{1}{5}\right)} = 0.242 \text{ (3dp)}$$

$$t = \frac{M_1-M_2}{s_{M1-M2}} = \text{—} = 2.231\text{(3dp)}$$

Reject H_0 if $|t| \geq tc$

Since, 2.231< 2.306, therefore we retain H_0

Evidence suggests that, at .05 confidence two-tailed test, the new drug does not lower temperature significantly.

*You can choose either a hypothesis test or confidence interval, the solution is just for hypothesis test

15. C - *Rationale: As stated in Lecture 8.*

16. A - *Rationale: Stated in Lecture 8 (Week 4). ρ is the population correlation so the ρ in the null hypothesis in between-samples design is 0 (no correlation). Ergo when the ρ is larger than 0, the standard error will end up being smaller according to the formula:*

$$\sigma_{M1-M2} = \sqrt{\sigma^2_{M1} + \sigma^2_{M2} - 2\rho\sigma_{M1}\sigma_{M2}}$$

17. The size of α (level of significance): decrease in α level → decreases power (vice versa); the directionality of H_1; size of effect: larger effect → increases power (vice versa) , size of σ: increase σ → decrease power (vice versa), size of n: increase n → increase power (vice versa)

Rationale: As stated in lecture 9, slides 6-9

18. Cohen's guidelines for effect size are a set of standardized criteria for interpreting the magnitude of effects in research studies. It measures the standardised difference between two means. *δ* value of 0.2 is considered a small effect size, *δ* value of 0.5 is considered a medium effect size, *δ* value of 0.8 or higher is considered a large effect size

Rationale: As stated in lecture 9, slide 13

19. 89%

Rationale: Determine values for n, α and γ where n = 16, α = .05. Look at Table 3 (statistics tables) to convert to 1 - β

20. At least 85 participants per group (total of 170 participants) are needed to have a 90% chance of detecting an effect size of *γ*=0.5.

Rationale: α = 0.05, 2-tailed, 1-β =0.8, γ=0.5. Use Table 4 to determine δ = 3.242.

Use $n = 2(\frac{\delta}{\gamma})^2$ *(independent samples)* $= 2(\frac{3.242}{0.5})^2 = 84.1$

21. small effect:17%, medium effect: 71%, large effect: 98%

Rationale: $\delta = \gamma\sqrt{n/2}$ *(independent means) - small effect:* $\delta = 0.2\sqrt{50/2} = 1$*, medium effect:* $\delta = 0.5\sqrt{50/2} = 2.5$*, large effect:* $\delta = 0.8\sqrt{50/2} = 4$*. From Table 3, convert to 1 - β*

22. By manipulating the independent so that it increases the effect size, it becomes easier to detect a real effect, leading to increased statistical power.

Rationale: As stated in lecture 10, slide 26.

23. The main difference between an exploratory test and a confirmatory test is the purpose of the test. An exploratory test is conducted when there is little existing knowledge about a phenomenon, and the purpose is to generate hypotheses and ideas for further investigation. In contrast, a confirmatory test is conducted when there is a well-defined hypothesis or theory, and the purpose is to test whether the data supports or refutes that hypothesis or theory.

24. $= 1 - (1 - 0.05)^{28}$
$= 0.762$
There was 76.2% chance that at least one of the 28 experiments would reject H0, even if H0 was true.

25. $H_o: \rho = 0$
$H_1: \rho \neq 0$
df = 30 - 2 = 28, $t_c = 2.048$ (df = 28, $\alpha = 0.05$)
$t = r * \sqrt{\frac{n-2}{1-r^2}} = 0.67 * \sqrt{\frac{30-2}{1-(0.67)^2}}$
= 3.968 (3dp)
Decision rule: | 3.968 | > 2.048, reject H_0
Conclusion: at the 0.05 level of significance, there is sufficient evidence to conclude that the correlation between variables X & Y in the population is not 0.

26. $\delta = \gamma \sqrt{n-1} = 0.2 * \sqrt{103-1} = 2.02$
From table 3, a δ of 2.02 gives power (1-β) of 0.59
∴ There is a 59% chance of detecting a population correlation of 0.2

27. $Z_{(pop.\ density)} = \frac{9000-6031}{741}$
= 4.007 (9000 is 4.007 standard deviations above 6,031)
$Z_{(house\ price)} = r \times Z_{(pop.\ density)} = 0.75 \times 4.007 = 3.005$
y' => $3.005 = \frac{y'-516000}{34400}$
y' = 34400 x 3.005 + 516000
= 154980.60
∴ Predicted value is $154980