Statistics 2035 – Practice Final #2 (covers chapters 2 through 9)

1. A box contains a coin that is believed to be unfair (P(heads) ≠ 0.5). To test this claim, the coin is flipped 50 times. Sixty-six percent of the time, heads were observed. Calculate the appropriate p-value to test H_o.

   a. 0.0226 b. 0.0238 c. 0.0119 d. 0.0452

2. The number of errors in a textbook is about 1.1 for every 100 pages. In a 400-page text, what is the chance that there will be less than half the average number of errors?

   a. 0.3770 b. 0.01074 c. 0.05469 d. 0.18514

3. A student has just written a 10 question true – false quiz without studying, so they had to guess the answer to each question. What is the probability that the student will get at least 3 questions right?

   a. 0.9990 b. 0.8281 c. 0.9453 d. none of these

4. The weights of a large group of first year students are Normally distributed with an expected value of $\mu = 80$ kg. with a standard deviation of $\sigma = 12$ kg. How many students would need to be selected so that the average weight of the sample has a standard deviation of no more than 3.21 kg.?

   a. 3 b. 4 c. 14 d. 13

5. A random sample of 60 observations was collected from a Normal population, with a known variance, in order to construct a 95% confidence interval for μ. Now, if only 15 observations had been collected, what would happen to the length of the confidence interval?

   a. the interval constructed using 15 observations would be half as long as the one using 60 observations.
   b. the interval constructed using 15 observations would be twice as long as the one using 60 observations.
   c. the interval constructed using 15 observations would be one-quarter of the length of the one using 60 observations.
   d. the interval constructed using 15 observations would be four times as long as the one using 60 observations.

*****Use the following information for the next TWO questions:**

IQ scores follow an approximate normal distribution with mean 110 a variance of 100

6. What percentage of people will score lower than 105?

   a. 0.6915 b. 0.4801 c. 0.5199 d. 0.3085

7. You are told that roughly 3% of this population has an IQ score higher than some value x_0. What is the value of x_0?

   a. 128.8 b. 288 c. 81.2 d. 131.7

8. Which of the following statement(s) about the following hypothesis test: H_o: $\mu_1 - \mu_2 = 0$ vs. H_a: $\mu_1 - \mu_2 < 0$ is / are correct at the 5% level of significance?

   1. We will reject H_o if the p-value < 0.05.
   2. We will reject H_o if Z < 1.96.
   3. We will reject H_o if Z < -1.96.
   4. We will reject H_o if Z < 1.645.

   a. All are correct b. 1. and 3. c. 1. and 2. d. 1. only

9. Let Z be a standard normal random variable. Find z such that P(|Z| > z) = 0.8.

   a. 1.28 b. −0.84 c. 0.84 d. 0.25

10. Consider the following hypotheses: H_o: $\mu_1 - \mu_2 = 0$ vs. H_a: $\mu_1 - \mu_2 \neq 0$. A two-sided 95% confidence interval was calculated to be (−1.9, 5). Which of the following conclusions is correct at $\alpha = 5\%$?

    a. We reject H_o since 0 is included in the 95% confidence interval.
    b. We cannot reject H_o since 0 is included in the 95% confidence interval.
    c. We reject H_o since 0 is not included in the 95% confidence interval.
    d. We cannot reject H_o since 0 is not included in the 95% confidence interval.

11. Adult salmon have lengths that are normally distributed with a mean of $\mu = 70$ cm and a standard deviation of $\sigma = 5.4$ cm. What is the probability that a random sample of n = 10 fish caught will have an average length greater than 75 cm?

    a. 0.17% b. 99.83% c. 17.62% d. 82.38%

*****Use the following information for the next TWO questions:**

You are given the following salary data (in $1,000):

25, 41, 81, 20, 54, 33, 43, 27, 19, 29, 61, 67, 51, 44, 91, 22, 70, 67, 92

12. What is the IQR of the salaries?

    a. 39 b. 40 c. 38 d. 37

13. Which of the following observations are classified as outliers?

    a. 70, 81, 91, and 92 b. 19 and 92 c. 19, 91, and 92 d. there are no outliers present

14. An experimenter measures the Normally distributed failure times of a random sample of 25 components. The sample average is 52.43 hours and the sample standard deviation is 3.93 hours. Calculate the p-value we would use to determine whether or not there is sufficient evidence for the experimenter to conclude that the average failure time of the components is at least 50 hours.

    a. 0.01 < p-value < 0.05 b. 0.02 < p-value < 0.10 c. 0.001 < p-value < 0.005 d. 0.002 < p-value < 0.01

15. The strengths of fibres was Normally distributed. A random sample of 14 fibres was tested. Their strength had a sample average of 266.5 and a sample standard deviation of 18.6. Calculate the appropriate p-value needed to assess whether or not there is evidence to suggest that the average strength of fibres of this type exceeds 260.

    a. p-value = 1.31 b. p-value = 0.0981 c. p-value > 0.10 d. p-value < 0.05

16. Consider the following two-sided 99% confidence interval for μ: (10, 50). With everything else held constant, what happens to the length of the confidence interval if the confidence level drops to 90%?

    a. We cannot say since we don't know whether we are using t procedures or z procedures.
    b. The confidence interval will be longer if the confidence level drops to 90%.
    c. The confidence level has no effect on the length of the interval.
    d. The confidence interval will be shorter if the confidence level drops to 90%.

17. If a car's paint starts to peel (P), there is a 60% chance it will have major rust problems within 2 years (R). The chance of P itself is 35%. Then, $P(P \text{ and not } R)$ would be:

    a. 21% b. 14% c. 25% d. 20%

18. An experimenter would like to construct a 95% two-sided z-interval, with a length of at most 0.2 ohms, for the average resistance of a segment of copper cable of a certain length. If the experimenter believes that the standard deviation of such resistances is known to be 0.5 ohms, what is the minimum sample size you would recommend?

    a. 96 b. 97 c. 98 d. 99

19. Which statement best describes a p-value?

a. It is the probability that H_o will be rejected.
b. It is the probability that H_o is true.
c. It's the probability of observing a sample value as extreme or more extreme than the value observed given that H_o is true.
d. It's the probability that H_o is true given that we observe a sample value as extreme or more extreme than the value actually observed.

20. Which statement best describes a 95% confidence interval for μ?

a. There is a 95% chance that the sample mean lies in the interval.
b. 95% of the sample values will be contained in that confidence interval.
c. There is a 95% chance that the population mean will lie in the interval.
d. If we sampled from the same population over and over again, using the same sample size each time, and constructed many confidence intervals, we would expect that 95% of the confidence intervals constructed would contain the population mean.

21. Which situation best describes a type I error? Remember that you are presumed innocent until shown otherwise.

a. setting a guilty person free
b. convicting an innocent person
c. convicting a guilty person
d. setting an innocent person free

22. A random sample of n Normal observations gave a 95% confidence interval for a mean: $62 < \mu < 68$. If the population variance is known, then we see that the 90% confidence interval for μ is

a. $62.48 < \mu < 67.52$ b. $59.96 < \mu < 70.04$ c. $61.43 < \mu < 68.57$
d. not possible to construct—not enough information

23. In which one of these cases would you be **most** justified in calling your result "not statistically significant" at $\alpha = 5\%$?

a. When a 95% confidence interval based on 25 observations just barely excludes the null hypothesis value.
b. When a 95% confidence interval based on 30 observations barely includes the null hypothesis value.
c. When the p-value for H_0 is 0.010, based on a sample of 100 observations.
d. When the p-value for H_0 is 0.004, based on a sample of 25 observations.

24. Suppose the probability distribution of a random variable X can be described by the formula $p(x) = P(X = x) = \frac{k}{x}$ for each of the values of X = 1, 2, 3, and 4. What is the expected value of X?

a. k b. 4k c. 10k d. 1

25. We wish to test H_o: $p = 0.5$ vs. H_A: $p \neq 0.5$. Based on n = 120 observations, the 95% confidence for a population proportion turned out to be $p = 0.59 \pm 0.088$. At the significance level $\alpha = 5\%$, the result is:

a. statistically significant, because 0 is not included in the interval.
b. statistically significant, because 0.5 is not included in the interval.
c. not statistically significant, because 0.5 is not included in the interval.
d. not statistically significant, because 0.5 is included in the interval.

26. Boxes of fruit leaving a packing plant in Florida weigh 49 pounds on average, with a standard deviation of 4.3 pounds. If 100 boxes of fruit are loaded onto a truck with capacity 5,000 pounds, what is the chance that the truck is not overloaded?

a. 0.0099 b. 0.033 c. 0.5910 d. 0.9901

27. In a very large shipment of cell phone batteries, 20% were defective. In a random sample of 25, what is the approximate chance that more than 8 would be defective? (Use any necessary continuity corrections here if applicable).

a. 0.0175 b. 0.11 c. 0.0401 d. 0.0228

28. A Research and Development Laboratory researcher for a paint company is measuring the level of a certain chemical contained in a certain type of paint. If the paint contains too much of this chemical, the quality of the paint will be compromised. On the average, the proportion of chemical in each can is 10%. How many cans of paint should the sample contain if the researcher wants to be 98% certain of being within 1% of the true proportion of this chemical?

a. 4,870 b. 3,458 c. 645 d. 5,936

29. A researcher plans to conduct a hypothesis test at the $\alpha = 0.01$ significance level. She designs her study so that the probability of a type II error is 0.10 (for some fixed value of the parameter of interest). What is the probability that the researcher will not reject a correct null hypothesis?

a. 0.99
b. 0.10
c. 0.90
d. probability = p-value and cannot be calculated until the data is collected

30. Unoccupied seats on flights cause airlines to lose revenue. Suppose a large airline wants to estimate its average number of unoccupied seats per flight over the past year. A sample of flight records is randomly selected and the number of unoccupied seats is noted with a sample mean of 11.6 seats. Suppose that it is known that the population standard deviation is 4.1 seats. How many flights should we select if we wish to estimate μ to within 2 seats and be 99% confident?

a. 6 b. 27 c. 28 d. 55

31. Suppose that one wishes to test H_0: $\mu = 0$ vs H_a: $\mu > 0$ on the basis of a random sample of size 16 from a normal population whose variance is 1. Using a rejection point, it is determined that H_0 will be rejected if the observed test statistic, $Z > 1.34$. What is the probability of a Type I error?

a. 5% b. 9.01% c. 1.34% d. cannot be determined

32. In order to determine if the average salary (in \$1000's) between male and female faculty members at a local University was different or not, a random sample of the salaries of 7 male faculty and 8 female faculty members was taken. Suppose that the estimated difference was 5 and the pooled sample variance was 12.617. Use this information to test the null hypothesis that the difference, $\mu_1 - \mu_2 = 0$ against the alternative hypothesis that $\mu_1 - \mu_2 \neq 0$. Which of the following decisions is correct?

a. If $\alpha = 0.02$, we would not reject H_o.
b. If $\alpha = 0.02$, we would reject H_o.
c. If $\alpha = 0.01$, we would reject H_o.
d. If $\alpha = 0.005$, we would reject H_o.

33. Suppose that we randomly select two independent samples from two normal populations, with means μ_1 and μ_2. If $\bar{x}_1 = 25$ and $\bar{x}_2 = 20$, $\sigma_1 = 3$ and $\sigma_2 = 4$, and $n_1 = 100$ and $n_2 = 100$. If a 95% confidence interval was used to test H_o: $\mu_1 - \mu_2 = 0$ vs. H_a: $\mu_1 - \mu_2 \neq 0$, is there statistical evidence to suggest that $\mu_1 \neq \mu_2$ at the $\alpha = 5\%$ level of significance?

a. No, since the null value would not lie inside the 95% confidence interval.
b. No, since the null value would lie inside the 95% confidence interval.
c. Yes, since the null value would not lie inside the 95% confidence interval.
d. Yes, since the null value would lie inside the 95% confidence interval.

34. Suppose that we wish to compare the average weights of hockey players from two local hockey teams. Two independent random samples were taken, of sizes $n_1 = n_2 = 7$ from two normally distributed populations with means μ_1 and μ_2. The samples yielded the following results: $\bar{x}_1 = 240$ and $\bar{x}_2 = 210$, $s_1 = 5$ and $s_2 = 6$. Test H_o at the 5% level of significance and decide whether or not there is statistical evidence to suggest that the mean weights differ by more than 20 pounds.

a. We would reject H_o and conclude that it appears as though the weights differ by more than 20 pounds.
b. We would not reject H_o and conclude that it appears as though the weights differ by more than 20 pounds.
c. We would reject H_o and conclude that it appears as though the weights do not differ by more than 20 pounds.
d. We would not reject H_o and conclude that it appears as though the weights do not differ by more than 20 pounds.

35. Two samples were taken from two approximately normal populations. They represent the typing speeds in words per minute for males and females:

Males	61	54	62	63	54
Females	63	57	59	64	51

The population variances are unknown but can be assumed to be equal. The sample standard deviations for males and females are 0.444 and 0.522 respectively. Which of the following methods should be used to test for the equality of population means?

a. Paired t-test with d.f. = 4
b. Two-sample z-test.
c. Two-sample t-test with d.f. = 5
d. Two sample t-test with d.f. = 8

36. To compare the fuel efficiency of two types of gasoline, five cars were randomly selected, the type of gasoline used was randomly determined, and the fuel efficiency achieved using each brand was recorded below for each car:

Car	Type A	Type B
1.	8.4	7.9
2.	7.8	7.1
3.	11.3	10.9
4.	8.1	7.3
5.	6.6	5.7

Some potentially useful information: $\bar{x}_A = 8.44, s_A = 1.74, \bar{x}_B = 7.78, s_B = 1.92$
$s_d = 0.2074$, where d = difference, Type A - Type B

You can assume that the differences are normally distributed. Calculate a 95% confidence interval for the mean difference in fuel efficiency for the two types of gas. Does the interval provide evidence to suggest that there is a statistically significant difference in the mean fuel efficiencies between the two fuel types?

a. [0.4, 0.92], No. b. [0.4785, 0.8414], Yes. c. [-0.8414, -0.4785], No. d. [0.4, 0.92], Yes.

37. To determine whether Canadians and Americans had differing opinions on the war against terror, 50 Canadians were randomly selected and 75 Americans were randomly selected and asked about their view on the war. Results showed that 36% of Canadians favoured the war while 44% of the Americans polled favoured the war. It is suspected that the difference between the proportion of Americans and the proportion of Canadians that favour the war is less than 9%. Calculate the appropriate p-value to test this claim.

a. 0.1126 b. 0.4562 c. 0.5438 d. 0.1292

38. Suppose that two independent samples, of sizes $n_1 = 5$ and $n_2 = 16$, taken from two normally distributed populations with variances σ_1^2 and σ_2^2 give sample standard deviations of $s_1 = 5$ and $s_2 = 9$. In order to test H_0: $\sigma_1 = \sigma_2$ vs. H_a: $\sigma_1 \neq \sigma_2$ at the 5% level of significance, calculate the test statistic that should be used and determine the appropriate d.f. to be used (if $d.f._1$ = numerator d.f. and $d.f._2$ = denominator d.f.).

a. F = 16/5 with $d.f._1 = 4$ and $d.f._2 = 15$.
b. F = 9/5 with $d.f._1 = 15$ and $d.f._2 = 4$.
c. F = 25/81 with $d.f._1 = 4$ and $d.f._2 = 15$.
d. F = 81/25 with $d.f._1 = 15$ and $d.f._2 = 4$.