STA 4170 — Exam 2 — Fall 2000 — Print Name: _____

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The following 3 questions are based on the following information

A pharmaceutical firm wishes to compare the bioavalabilities of two formulations of a drug. They take a sample of $n = 18$ adults, and have each subject take each formulation. The area under the concentration vs time curve (AUC) is obtained for each subject on each drug. The difference between formulations A and B is obtained for each subject.

1) This is an example of a:

a) Parallel groups design/Observational study
b) Parallel groups design/Controlled experiment
c) Crossover design/Observational study
d) Crossover design/Controlled experiment

2) The mean and standard deviation of the differences are 50.0 and 125.0, respectively. Give a 95% confidence interval for the population mean difference.

a) $(-213.8, 313.8)$ b) $(-12.2, 112.2)$ c) $(12.2, 112.2)$ d) $(35.3, 64.7)$

3) **Regardless of your answer to the previous problem**, suppose a researcher reports that a 95% confidence interval for the population mean difference is (20.0,80.0). Which statement is most appropriate at the $\alpha = 0.05$ significance level?

a) Conclude that mean AUC is higher for formulation A
b) Conclude that mean AUC is higher for formulation B
c) Do not conclude that mean AUC differs between the two formulations

4) A case–control study was conducted, where 500 patients with disease X were matched with 500 patients without disease X (controls). Among the disease X patients, 200 had taken a particular OTC medication. Among the controls, 50 had taken the OTC medication. Give the estimated odds ratio:

$$\frac{\text{odds of exposure to OTC drug|disease X present}}{\text{odds of exposure to OTC drug|disease X absent}}$$

a) 2.0 b) 4.0 c) 2/3 d) 6.0

5) A cohort study is conducted, following a group of adults taking a diet medication and a similar control group of adults not on the medication. The outcome of interest was whether or a person develops a particular heart condition within five years of beginning teatment. The following table gives the study results. Obtain the estimated relative risk of heart condition for the diet group relative to the control group.

	Heart Condition		
Group	Yes	No	Total
Diet	40	960	1000
Control	30	970	1000
Total	70	1930	2000

a) 1.33 b) 1.15 c) 0.75 d) 2.45

The following 2 questions are based on the following information

A study comparing adverse reactions to 3 brands of OTC pain killer led to the following counts of patients with and without adverse reactions (AR).

Drug	AR	No AR	Total
A	40	160	200
B	60	140	200
C	110	90	200
Total	210	390	600

6) Under the null hypothesis of no association between the drug and the onset of adverse reaction, how many patients would you expect to have reported adverse reactions on drug A (exp_{11})? What would be the contribution to the χ^2 statistic (X^2_{11}).

a) $exp_{11} = 40$, $X^2_{11} = 0$ b) $exp_{11} = 60$, $X^2_{11} = 6.7$
c) $exp_{11} = 70$, $X^2_{11} = 22.5$ d) $exp_{11} = 70$, $X^2_{11} = 12.9$

7) What would the rejection region for this test (at $\alpha = 0.05$ significance level)?

a) $RR : X^2_{obs} \geq 5.991$ b) $RR : X^2_{obs} \leq 5.991$ c) $RR : X^2_{obs} \geq 12.592$ d) $RR : X^2_{obs} \leq 12.592$

The following 2 questions are based on the following information

A study was conducted to compare 4 treatments for weight loss. A sample of 32 overweight adults was obtained and each was assigned at random to one of the 4 treatments (8 patients received each treatment). The response measured was the amount of weight lost, and you are given the following quantities (assume the populations of measurements are normally distributed):

$$\sum_{i=1}^{4} 7S_i^2 = 560 \qquad \sum_{i=1}^{4} 8(\overline{Y}_i - \overline{Y})^2 = 300$$

8) Give the appropriate test statistic for testing:

$$H_0 : \mu_1 = \mu_2 = \mu_3 = \mu_4 \qquad H_A : \text{ Not all } \mu_i \text{are equal}$$

a) $F_{obs} = 0.54$ b) $F_{obs} = 0.71$ c) $F_{obs} = 5.00$ d) $F_{obs} = 7.25$

9) Give the rejection region for this test (based on $\alpha = 0.05$ significance level):

a) $RR : F_{obs} \geq 2.95$, Conclude that the means are not all equal.
b) $RR : F_{obs} \geq 2.95$, Do not conclude that the means differ.
c) $RR : F_{obs} \geq 6.59$, Do not conclude that the means differ.
d) $RR : F_{obs} \geq 6.59$, Conclude that the means are not all equal.

10) A researcher is interested in determining whether there is an association between use of a drug and presence of a specific heart condition. They conduct a cross–sectional study looking at all records of patients in a large HMO database. They believe that the age distribution for people who do take the drug has a lower mean than the age distribution for those who don't. They also believe that all else being equal, older patients have a higher risk of getting the heart condition. Which test is most appropriate to test for this association?

a) Pearson's χ^2 test.
b) Kruskal–Wallis test
c) Fisher's Exact test
d) Mantel–Haenszel test

11) All else being equal, as sample sizes increase, the width of all of the confidence intervals we compute:

a) increase b) decrease c) cannot determine

The following 2 questions are based on the following information

Three medications are to be compared in terms of the mean decrease in blood pressure among males with hypertension. A random sample of $n = 30$ men was selected, with 10 being assigned at random to each treatment. The sample means and the Mean Square Error (MSE) are given below:

$$\overline{Y}_1 = 15.0 \qquad \overline{Y}_2 = 5.0 \qquad \overline{Y}_3 = 25.0 \qquad MSE = 50.0$$

12) Give approximate simultaneous 95% confidence intervals for $\mu_1 - \mu_2$, $\mu_1 - \mu_3$, and $\mu_2 - \mu_3$, respectively:

a) (2.18,17.82) $(-17.82, -2.18)$ $(-27.82, -12.18)$
b) (3.51,16.49) $(-16.49, -3.51)$ $(-26.49, -13.51)$
c) (3.80,16.20) $(-16.20, -3.80)$ $(-26.20, -13.80)$

13) Based on your confidence intervals, which statement is most appropriate?

a) $\mu_1 > \mu_2$ $\mu_1 > \mu_3$ $\mu_2 > \mu_3$
b) $\mu_1 > \mu_2$ $\mu_1 < \mu_3$ $\mu_2 < \mu_3$
c) $\mu_1 > \mu_2$ $\mu_1 = \mu_3$ $\mu_2 < \mu_3$
d) $\mu_1 = \mu_2$ $\mu_1 = \mu_3$ $\mu_2 = \mu_3$

14) In a study reporting side effects of a nicotine patch, subjects received either a low, medium, or high dose patch. They reported their perceived level of exhaustion as none, moderate, or extreme. Four of the subjects are described below:

Bill – Low dose patch, extreme exhaustion

Brenda – High dose patch, moderate exhaustion

Bob – Medium dose patch, no exhaustion

Barbara – Medium dose patch, moderate exhaustion

Which pairs of patients are concordant and discordant?

a) Concordant: None Discordant: None
b) Concordant: Barbara/Brenda Discordant: Barbara/Bob
c) Concordant: Brenda/Bob Discordant: Bill/Brenda, Bill/Bob, Bill/Barbara
d) Concordant: None Discordant: Bill/Brenda, Bill/Bob, Bill/Barbara

The following 3 questions are based on the following information

A case–control study among males suffering from a rare condition and a similar group of controls who do not suffer from the condition, found that among the 300 men suffering from the condition, 100 had taken Viagra and 200 had not. Among the 300 controls, 40 had taken Viagra and 260 had not.

15) Obtain a 95% confidence interval for the population odds ratio for viagra users relative to controls.

a) (2.98,3.54) b) (3.16,3.34) c) (2.84,3.66) d) (2.16,4.90)

16) Based on your confidence interval what are you willing to conclude regarding the population odds ratio?

a) Higher odds for Viagra users.
b) Higher odds for controls.
c) Cannot conclude odds differ for the two groups.

17) Among men in the general population, what is the estimated probability that a man on Viagra suffers from the condition?

a) 0.71 b) 0.33 c) 0.17 d) Cannot determine

18) A study reports that based on Fisher's exact test, the probability that the researchers could have received this strong or stronger evidence in favor of a decreased risk in death from a new treatment (compared to an old treatment) is .023. Are they appropriate in concluding that the new treatment is better than the old if the test is based on $\alpha = 0.05$ significance level?

a) No b) Yes c) Need more information