Name _____

Show your work to get full credits. Each question is worth 5 points except where indicated. **Use alpha = .05 for all the hypothesis tests**.

1.The paper “Effect of long-term blood pressure control on salt sensitivity” describes a study evaluating salt sensitivity after a period of antihypertensive treatment. Five hypertensive patients were studied after a certain time on antihypertensive treatment. Salt sensitivity readings, which were obtained before and after the same patient was placed on an antihypertensive treatment, are given here:

patient	1	2	3	4	5
Before	22.86	7.74	15.49	9.97	1.44
After	16.11	-4.02	8.04	3.29	-0.77

Conduct a hypothesis test to determine if the mean salt sensitivity value decreased after the patient received antihypertensive treatment. (7 points)

2. A cigarette manufacturer has advertised that it has developed a new brand of cigarette, LowTar, that has a different average tar content than the major brands A B C and D. To evaluate this claim, a consumer testing agency randomly selected 100 cigarettes from each of the four major brands and the new brand. The results is shown below.

Brand	sample size	sample mean	sample s.d.
LowTar	100	8	0.3
A	100	10	0.4
B	100	10	0.4
C	100	11	0.5
D	100	11	0.5

a.Is there evidence to conclude that there is significant differences in the average tar contents from the above five brands of cigarettes? (8)

b.Was there any evidence of a violation in the required conditions to conduct the analysis in part a?

3. A petroleum company was interested in comparing the miles per gallon achieved by four different gasoline blends (A, B, C and D). Because there can be considerable variability due to differences in car models, the company selected 4 car models and obtained gasoline consumption from A,B,C and D on each car model. The mileage (in mpg) obtained over each test run was recorded below.

Gasoline	car model				
	1	2	3	4	sum
A	15	33	13	29.2	90.2
B	16.3	26.4	19.1	22.5	84.3
C	10.5	31.5	17.5	30.1	89.6
D	14.0	34.5	19.7	21.6	89.8
Sum	55.8	125.4	69.3	103.4	353.9

(a) What experimental design is this one? Circle your answer.

Completely randomized design

Randomized block design

(b) Write an appropriate statistical model for this experimental situation. Please explain the symbols you use in the model. (3)

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(c) Please complete the ANOVA table. Show your work to get full points. (10)

(d) . State the hypothesis to determine if there is any difference among the treatment means. What is the test statistic for the hypothesis? What is the approximate p-value of your test? What is your decision?

Don't answer questions (e) and (f) if you circled "completely randomized design".

(e). If you circled "randomized block design" in part (a), what is your extraneous variable? state the hypothesis to determine if there is any difference among the block effects. What is the test statistic for the hypothesis? What is the approximate p-value of your test? What is your decision?

(f). If you circled "randomized block design" in part (a), what is the relative efficiency for the experiment? (3)

4. Researchers record the yields of corn, in bushels per plot, for three different varieties of corn, A, B and C. In a greenhouse experiment, the researchers randomly use each variety on 4 of 12 plots available for the study. The yields are listed here:

					sum
A	2.2	3	2.7	2.7	10.6
B	3.6	3.9	4.1	4.3	15.9
C	4.3	4.4	4.5	4.1	17.3
Sum	10.1	11.3	11.3	11.1	43.8

(a) What experimental design is this one? Circle your answer.

Completely randomized design

Randomized block design

(b) Please complete the ANOVA table for this data. (10)

(c) . State the hypothesis to determine if there is any difference among the averages from brand A,B and C. What is the test statistic for the hypothesis? What is the approximate p-value of your test? What is your decision? (4)

(d). If you circled “randomized block design” in part (a), what is your extraneous variable? State the hypothesis to determine if there is any difference among the block effects. What is the test statistic for the hypothesis? What is the approximate p-value of your test? What is your decision? (3) Don’t answer this question if you circled “completely randomized design”.

(e) If appropriate, use a method to determine if there is a difference between brand A and brand B. (4)

5. In a study to determine whether the price of a product can be used to predict quantity sold. Six random prices for a product were selected. Price (in dollars) and quantity sold in a day were recorded for each of the six prices. Assume the assumptions for conducting inference have been satisfied.

price	Quantity sold
58.7	20
59	15
60.1	17
61.3	16
63.2	13
64	11

(a) What is the dependent variable? What is the independent variable? (3)

(b) Conduct a hypothesis test to determine if the independent variable is useful to predict the dependent variable. (8)

6. The costs of major surgery vary substantially from one state to another due to differences in hospital fees, malpractice insurance cost, doctors' fees, and rent. A study of hysterectomy costs was done in California and Michigan. Based on a random sample of 19 patient records from both states, the sample statistics shown here were obtained.

State	n	sample mean	sample s.d.
Michigan	10	$8458	$250
California	9	$9690	$420

a. Justify your choice between the pooled t-test and the separate t-test.

b. Is there sufficient evidence that California has a higher mean hysterectomy cost than Michigan? Use your decision in part a. (7)

c. Estimate the difference in the mean costs of the two states using a 95% confidence interval. Use your decision in part (a). (3)

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