

CAMPION COLLEGE & UNIVERSITY OF REGINA
DEPARTMENT OF MATHEMATICS & STATISTICS
STATISTICS 200-C70
Final Examination
Summer 2015

Time: 3 hours

NAME: _____

Instructor:

Vijayarparvathy Agasthian

ID: _____

Show all of your work on the exam paper.

MARKS

- [8] 1. A local county is considering a budget proposal that would allocate extra funding toward the renovation of city parks. A survey is conducted to measure public opinion concerning the proposal. A total of 150 individuals respond to the survey: 50 who live within the city limits and 100 from the surrounding suburbs. The frequency distribution is as follows:

	Opinion		
	Favor	Oppose	Total
City	35	15	50
Suburb	55	45	100
Total	90	60	150

Is the distribution of opinions for city residents and suburbs are dependent? Test at 1% level of significance.

- [12] 2. The cutting speeds of four tools were compared in an experiment. Five materials of varying degrees of hardness were used as experimental blocks. The ANOVA table of this experiment is given in the following table:

Source	df	SS	MS	F
Treatments	3	?	103.3	?
Blocks	4	184	?	?
Error	12	24	?	
Total	19	?		

- Find the missing values in the table.
- Do the data provide sufficient evidence to indicate a difference in the cutting speeds of 4 types of tools. Test using $\alpha = 0.01$.
- Find 90% confidence interval to estimate the difference in hardness of material 1 and material 3.

- [6] 3. Two geological formations are compared with respect to richness of mineral content. The mineral contents of 7 specimens of ore collected from formation 1 and 5 specimens collected from formation 2 are measured by chemical analysis. Use Wilcoxon Rank Sum Test. The following data are obtained:

Table 1: Mineral Content

Formation 1	7.6	11.1	6.8	9.8	4.9	6.1	15.1
Formation 2	4.7	6.4	4.1	3.7	3.9		

Do the data provide strong evidence that formation 1 has a higher mineral content than formation 2? Test using $\alpha = 0.05$.

- [8] 4. Would you favor spending more federal tax money on the arts? This question was asked by a research group to 220 women and 175 men. 59 women and 56 men responded yes. Does this information indicate a difference between the population proportion of women and the population proportion of men who favor spending more federal tax dollars on the arts? Use $\alpha = 0.05$.

- [12] 5. Your Statistics instructor is interested in finding the relationship between the number of hours the students studied for STAT 200 final exam and the grade they received. The data show the number of hours, x , studied for an exam and the grade received, y .

Number of hours studied, x	8	9	5	4	10	3
Grade received, y	80	85	60	65	92	73

- a) Calculate the least-squares regression line.
- b) If a student studied for 7 hours, what is the student's predicted grade in STAT 200 using the regression line.
- c) Calculate the coefficient of determination r^2 .
- d) Determine whether there is a positive correlation between the number of hours studied and the grade received. Test at 2.5% level of significance.
- e) Estimate the student's grade in STAT 200 if the number of hours he/she studied is 7 hours, with a 95% confidence interval.

Note: $\sum x = 39$ $\sum y = 455$ $S_{xx} = 41.5$ $S_{yy} = 738.8333$ $S_{xy} = 146.5$
 $MSE = 55.4177$.

NAME: _____
STUDENT NO.: _____

NAME: _____
STUDENT NO.: _____

- [8] 6. The following are the average weekly losses of man-hours due to accidents in 10 industrial plants before and after a certain safety program was put into operation:

Before	45	73	46	124	33	57	83	34	26	17
After	36	60	44	119	35	51	77	29	24	11

Using the 5% significance level, test whether the safety program is effective?

- [10] 7. In order to study the relationship of advertising and capital investment with corporate profits, the following data, recorded in units of \$100,000, were collected for 10 medium sized firms in the same year. The variable y represents profit for the year, x_1 represents capital investment, and x_2 represents advertising expenditures.

y	15	16	2	3	12	1	16	18	13	2
x_1	25	1	6	30	29	20	12	15	6	16
x_2	4	5	3	1	2	0	4	5	4	2

We obtain the following ANOVA table:

Source	df	SS	MS	F
Regression	2	355.22	?	?
Error	7	76.38	?	
Total	9	?		

- a) If $b_0 = -8.177$, $b_1 = 0.2921$, $b_2 = 4.4343$, $SE(b_0) = 4.206$, $SE(b_1) = 0.1357$, $SE(b_2) = 0.8002$, find the least square regression line.
- b) Use the overall F test to determine whether the model contributes significant information for the prediction of y . Test using $\alpha = 0.01$.
- c) Does capital investment x_1 contribute significant information for the prediction of y , given that x_1 is already in the model? Test using $\alpha = 0.01$.

- [8] 8. Six samples, each consisting of 10 automobile tires, were selected, and the pressure (in pounds per square inch) in each tire was measured. The tires were filled by a machine on an automobile assembly line. The means and ranges for the samples are shown here. Construct and analyze an \bar{X} chart and an R chart for the data.

Sample	1	2	3	4	5	6
Mean	32.4	35.1	34.6	32.4	33.4	35.1
R	3.8	2.1	3.7	2.2	3.0	3.1

- [12] 9. A contractor wishes to see whether there is a difference in the time (in days) it takes two subcontractors to build three different types of homes. Use $\alpha = 0.05$

	Home type		
Subcontractor	I	II	III
A	25,28,26,30,31	30,32,35,29,31	43,40,42,49,48
B	15,18,22,21,17	21,27,18,15,19	23,25,24,17,13

The partial ANOVA table is as follows:

Table 3: ANOVA Table

Source	df	SS	MS	F
Subcontractor		1672.553		
Home Type		444.867		
Interaction		313.267		
Error		328.8		
Total		2759.487		

- a) Do the data provide sufficient evidence to indicate a difference in the means of the three different types of homes.
- b) Do the data provide sufficient evidence to indicate an interaction effect between the subcontractors and the types of homes.

- [8] 10. In a study of the palatibility of antibiotics in children, Dr. Doreen Matsui and colleagues used a voluntary sample of healthy children to assess their reactions to the taste of four antibiotics. The children's response was measured on a 10-centimetre (cm) visual analogue scale incorporating the use of faces, from sad (low score) to happy (high score). The minimum score was 0 and the maximum was 10. For the accompanying data (simulated from the results of Matsui's report), each of five children was asked to taste each of four antibiotics and rate them using the visual (faces) analogue scale from 0 to 10 cm.

Antibiotic				
Child	1	2	3	4
1	4.8	2.2	6.8	6.2
2	8.1	9.2	6.6	9.6
3	5.0	2.6	3.6	6.5
4	7.9	9.4	5.3	8.5
5	3.9	7.4	2.1	2.0

Use the Friedman F_r test to detect differences in the distributions of responses to the tastes of the four antibiotics. Test using $\alpha = 0.05$.

- [8] 11. To compare two elementary schools in teaching of reading skills, 12 sets of identical twins were used. In each case, one child was selected at random and sent to school A and his or her twin was sent to school B. Near the end of fifth grade, an achievement test was given to each child. The results follow:

Twin Pair	1	2	3	4	5	6	7	8	9	10	11	12	13	14
School A	177	85	150	112	95	102	120	117	86	111	110	142	125	89
School B	86	85	135	115	110	102	116	84	93	77	96	130	147	101

Use a 0.05 level of significance to test the hypothesis that the two schools have the same effectiveness in teaching reading skills against the alternate hypothesis that the schools are not equally effective. Use Paired Sign test.

NAME: _____
STUDENT NO.: _____