UNIVERSITY OF MARYLAND - EUROPEAN DIVISION

GNST 201: INTRODUCTION TO STATISTICS

Lecturer: Brian Cann

FINAL EXAM

Time Allowed: 120 minutes Use of Calculators, Formula Sheets, Tables permitted.

Full marks can be achieved for correct answers to 20 questions

It's Friday the 13th. The superstitious are getting cramped from crossing their fingers for so long. Cosmetics are being applied without the use of mirrors for fear of the seven years bad luck a breakage would bring. The market for four leafed clover is booming and more rabbits than usual were made physically challenged last night by the loss of a foot. Everywhere, normally sane and rational human beings are refusing to the leave their homes today for the fear that usually benign busses might start traveling on sidewalks and the rate of household accidents is rising...

The department of occultism and tourist management at the renown Pechvogel University has been studying the effect of an impending Friday 13th on citizen's feelings of safety and well-being. A group of 15 social science majors were given two evaluation tests to complete. The first test was designed to measure the strength of *internal locus of control*, a psychological construct that determines how much control individuals believe they have (or are prepared to exercise) over the things that happen to them. The second test measured the amount of importance the subjects attach to the date "Friday 13th". The results are displayed as percents in the table below:

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV
locus of control	23	54	29	87	69	92	57	36	84	86	83	42	91	63	75
Friday 13th	77	49	82	6	43	0	14	72	15	21	13	59	10	42	25

1. Illustrate the data on a scatter diagram, taking locus of control as the independent variable. Without calculating, interpret what the scatter diagram is telling us about the relationship between the two variables.

2. Calculate the mean and standard deviation for each of the variables.

3. Compute the correlation coefficient and the coefficient of determination for the distribution.
   (Note : $\Sigma X = 971,\ \Sigma X^2 = 70,605,\ \Sigma Y = 528,\ \Sigma Y^2 = 29,124,\ \Sigma XY = 25,728$)

4. Provide an interpretation of what the correlation coefficient and the coefficient of determination are telling us, including in your answer an explanation of what correlation analysis is able to reveal about the relation of the two sets of data.

5. What is linear regression and what can it be used for?

6. Compute the equation of the linear regression line for this set of data and plot the line on your scatter diagram.

7. (a) Compute the expected amount of importance attached to the date "Friday 13th" by a student who scores 67% on the locus of control test.
   (b) Compute the expected amount of importance attached to the date "Friday 13th" by a student who scores 0% on the locus of control test.
   (c) How reliable do you believe your results for a) and b) are as predictions for actual "importance of Friday 13th" scores? What implications does this have for presenting your results?

8. The research methodology used in collecting the data set comes under attack from researchers who claim that social studies students at Pechvogel University cannot be considered a representative sample of the population as a whole for this study. The implication is that the results are subject to bias. To illustrate their point, the critics present data from a sample of 40 subjects randomly selected from the inhabitants of the city of Pechvogel collected using the same test for measuring the amount of importance the subjects attach to the date "Friday 13th" as used in the original study. The sample data has a mean of 42.6 and standard deviation of 25.3. Does it appear that the critics' objection is justified? Justify your answer statistically.

9. It is reliably believed that the mean score on the locus of control test is 57.6. Does it appear that social studies students at Pechvogel University have a significantly stronger internal locus of control?

10. Why are hypotheses tests phrased in terms of population means, μ, when we appear to be comparing sample statistics?

11. Research published by the faculty of Hydraulics and Internal Medicine at a major midwest university suggests strongly that the measures of caution with which people carry out day to day activities on Friday 13th is not normally distributed. What implications does this have on our ability to carry out hypotheses tests on sample data drawn from this population?

12. After careful examination on the streets of Pechvogel City on the morning of Friday 13th, researchers conclude that 1 in 5 people prefer to cross over a busy street rather than remain on the sidewalk have to and walk under a ladder. A camera team wishing to produce a documentary on the dangers of crossing busy streets erects a ladder over a sidewalk on Friday 13th. If they film 15 pedestrians approaching the ladder, what is the probability that they will get footage of at least 5 people attempting to cross the road?

A paper prepared by the department of Astrophysics and Cosmetics at a reputable New England research institute details the number of casualty admissions at a major hospital on a sample of 45 Friday 13ths. The results are displayed on the histogram :

13. Describe the distribution, predicting the degree of skewness and the position of the mean and median.

14. Taking the figures from the histogram, recreate the frequency distribution table for the sample data.

15. Compute the mean, median and standard deviation for the sample using your answer to question 14.

16. Compute a 95% confidence interval for the population mean of casualty admissions on Friday 13th.

17. The mean number of casualty admissions in the same hospital on a day which isn't Friday 13th is 43. Determine if there is a significant difference in the number of admissions on Friday 13th compared with other days.

18. It is thought that superstitious people are more likely to attribute negative events to bad fortune on Friday 13th than is the case with non-superstitious people. A study conducted on Friday 13th found that the probability of finding a person who was superstitious in the casualty ward of the hospital was 45%. While 52% of all people admitted to the casualty department attributed their mishap to bad fortune, it was found that the probability of finding a patient who was both superstitious and attributed their accident to bad luck was 37%. Demonstrate mathematically that these events are not independent.

19. Explain the difference between independence and mutual exclusivity.

20. Regina has overcome her aversion to probability trees by learning 7 different ways of attempting each problem she suspects of requiring a tree. Four of these methods involve calculation, the other three involve drawing whilst cursing the problem-poser. To be on the safe side, given that it is Friday 13th, she attempts one problem requiring a tree by applying four different methods chosen at random. What is the probability that only one of these methods involve drawing?

21. A statistics course is required from almost every degree seeking student. Give your well rehearsed explanation why you believe this to be the case. Your answer should cover at least ten lines and preferably not mention lemmings.