Name: Student Number:

STAT 270 Surrey: Spring Semester 2015

Final Examination

21 April 2015   Instructor: Richard Lockhart

Instructions: This is a closed book test but you are allowed four sheets of US letter sized paper with as much on them as you want. You may use a calculator but not a computer or a phone. Your work will be marked for clarity of explanation. Explain what assumptions you are making and comment if those assumptions seem unreasonable. I want the answers written on the paper. I have provided a normal table and a t-table on a separate piece of paper. The exam is out of **40**.

1. I have two 4 sided dice – one red, one green. Each has the 4 sides labelled 1, 2, 3, and 4. When I toss one of these dice one side ends up face down and the number on the face down side is the one I have tossed.

   (a) If I toss the two dice what is the sample space? [1 mark]

   (b) In the previous problem what is the event that the sum of the two numbers tossed is 4? [1 mark]

   (c) Let A be the event that the sum of the two numbers tossed is 4 and B be the event that the sum of the two numbers tossed is even (one of 2, 4, 6, or 8, that is). Find $P(A|B)$ and $P(B|A)$. [3 marks]

2. The continuous random variable X has density

$$f(x) = \begin{cases} \frac{x+a}{2} & 0 \le x \le 1 \\ 0 & \text{otherwise} \end{cases}$$

(a) What is a? [1 mark]

(b) What is the cumulative distribution function of X? Sketch your answer. [2 marks]

(c) What is the variance of X? [2 marks]

3. A random sample of 400 eligible voters in Surrey is drawn. Of these 185 say they will vote yes on the transit referendum. An independent sample of 600 eligible voters in Vancouver gives 235 who say they will vote yes. At the 10% level test the hypothesis that there is no difference in voting intentions between the two municipalities. [4 marks]

4. We generally assume that when a coin is tossed it lands heads up with probability 0.5. It has been suggested, however, that if you do the experiment in a different way the chance might change. One such way is to stand the coin on edge on a hard flat surface, hold it upright with a finger and then flick the edge with a finger to send the coin spinning away.

A group of 107 statistics students actually did this, 40 times each for a total of 4280 spins. Suppose they got a total of 2376 heads. Give a 99% confidence interval for the probability that spinning produces heads. [4 marks]

5. Consider a population of adult men and assume that for a randomly picked man the length X of the right arm has a normal distribution with length μ_1 and the length Y of the left arm has a normal distribution with mean μ_2. Suppose that both X and Y have standard deviation σ. Suppose that X and Y have correlation $\rho = 0.98$. Let $Z = X - Y$ be the difference in lengths between the right and left arms.

   (a) Give a formula for the mean of Z. [1 mark]

   (b) Give a formula for the standard deviation of Z. [2 marks]

   (c) Now imagine you pick two men at random independently and let X be the length of the right arm of the first man and Y be the length of the left arm of the second man. Give formulas for the mean and standard deviation of $X - Y$. [2 marks]

   (d) In which situation is the standard deviation bigger? [1 mark]

4

6. If I toss a fair coin 6 times what is the exact chance that I get exactly 3 heads? [4 marks]

7. If I toss a fair coin 10000 times what is the (approximate) chance that I get exactly 5000 heads? [4 marks]

8. Ten precision measurements of a standard weight average 1.2 milligrams above the nominal weight of 1000 milligrams. The standard deviation of the 10 measurements is 1.3 milligrams. At the 5% level there clear evidence that the weight is not at the nominal level? [4 marks]

9. The random variable X has cdf

$$F_X(x) = \begin{cases} 0 & x < 0 \\ 1 - e^{-x} & x \geq 0 \end{cases}.$$

The random variable Y is defined by $Y = X^2$.

(a) Give a formula for the cdf $F_Y(y) = P(Y \leq y)$. [2 marks]

(b) Use the answer to the previous part to find the density of Y. [2 marks]

Final Exam Grade Sheet

Name: Student Number:

1a		1	1b		1	1c		3
2a		1	2b		2	2c		2
3		4	4		4	5a		1
5b		2	5c		2	5d		1
6		4	7		4	8		4
9a		2	9b		2	Total		**40**