

1. The following box plot of yearly incomes, given in thousands of dollars, was constructed from data collected in a neighbourhood outside of Ottawa.
 - (a) Is the distribution of yearly incomes skewed? Explain.
 - (b) What is the probability that a single sampled household will have a yearly income of less than \$29,000/year?
 - (c) What proportion of households have a yearly income of more than \$25,000 and less than \$29,000?
 - (d) Are any of the yearly incomes outliers? If so, identify them.

2. Parents who have brown eyes with one recessive blue gene each have a 25% chance of having a blue eyed child. Suppose a husband and wife both have brown eyes with a blue recessive gene, and the wife is pregnant on four different occasions. Assume that the occurrence of blue eyes in one child is independent of the occurrence of blue eyes in any other.
 - (a) What is the probability that none of the children have blue eyes.
 - (b) What is the probability that at least one child has blue eyes.
 - (c) Given that the first three children had brown eyes, find the probability that the fourth child has blue eyes.

3. An advertising executive is studying television viewing habits of married men and women during prime time hours. Based on past viewing records he has determined that during prime time hours husbands are watching television 60% of the time. It has also been determined that when the husband is watching television, 40% of the time the wife is also watching television and when the husband is not watching, 30% of the time the wife is watching. Find the probability that:
- (a) The wife is watching television during prime time.
 - (b) Given the wife is watching television, the husband is also watching television.
4. A certain type of car's transmission has a lifetime which is normally distributed with a mean of 6 years and a variance of 4 years². The manufacturer fully guarantees the transmission during the warranty period. If the manufacturer only wants to replace at most 5% of the cars' transmissions, how long should the warranty period be?
5. Let the distribution of a discrete random variable X be described as follows; where X represents the number of green candies in a bag of a certain brand of candy.

x	0	1	2	3
$p(x)$.2	.3	.3	.2

- (a) What is $E(X)$?
 - (b) What is the standard deviation of X ?
 - (c) What is the probability that a big box of 100 bags of this brand candy contains at least 60 bags which contain 2 or more green candies?
 - (d) What is the probability that the same box contains at least 160 green candies all together?
6. A truck loaded with 9000 electronic circuit boards has just pulled into a firm's receiving dock. The supplier claims that no more than 3% of the boards are defective. In a simple random sample of 300 boards from this shipment, 12 are found to be defective.
- (a) Construct the 90% confidence interval for the percentage of all boards in this shipment which are defective.
 - (b) How large a sample would be required to estimate this percentage within $\pm 1\%$ with 90% confidence?

7. The new director of a local YMCA has been told by his predecessors that the average member has belonged for 8.7 years. Examining a random sample of 15 membership files, he finds the mean length of membership to be 7.2 years, with a standard deviation of 2.5 years. Assuming the population is normally distributed:
- Give a 95% confidence interval for the average length of membership.
 - Carry out a significance test at 5% level to see whether the actual average length of membership may be something other than 8.7 years.
8. A motel manager, concerned with customer theft of towels, decided that the theft rate might be reduced by changing from white, imprinted towels to a drab green version. Of the 120 guests with the white towels, 35% took at least one towel with them when they checked out. Of the 160 guests given the drab green towels, only 25% checked out with one or more towels in their possession. At the 0.01 level of significance, can we conclude that the manager's idea is effective in reducing the rate of towel theft?
9. The Electrotemp Company is trying to persuade a microcomputer manufacturer to install Electrotemp cooling fans instead of the model that is now being used. According to Electrotemp, their fan will enable the computers to run cooler. The purchasing agent for the microcomputer firm randomly selects computers and measures their internal operating temperature with the current fan versus the Electrotemp model, with the results shown below. Using the 0.01 level of significance, would the Electrotemp claim appear to be credible?

Operating Temperature

Computer Number	Current Fan	Electrotemp Fan
1	116.6	114.0
2	115.7	102.5
3	110.3	112.4
4	118.7	108.2
5	120.3	105.3
6	116.0	112.6
7	116.6	109.5

FACULTY OF SCIENCE

FINAL EXAMINATION

MATHEMATICS 189-203A

BASIC PRINCIPLES & METHODOLOGY OF STATISTICS

Examiner: Professor M. Gu
Associate Examiner: Dr. R. Sturm-Beiss

Date: Tuesday, December 10, 1996
Time: 9:00 A.M. - 12:00 Noon

INSTRUCTIONS

Answer all questions. Notes or texts are not allowed, except a single $8\frac{1}{2} \times 11$ -inch sheet of paper written on both sides. Pocket calculators are allowed. In each question, state clearly any assumptions you make in applying a particular test or confidence interval. Tables of statistical distributions are given at the end of this examination paper.

This exam comprises the cover, 3 pages of questions and 2 pages of tables.