

1. An investigation is conducted to determine if the mean age of welfare recipients differs between St. Jean, Québec and St. John, New Brunswick. Random samples of 75 and 100 welfare recipients are selected from St. Jean, Québec and St. John, New Brunswick, respectively, and the following computations were made:

	St. Jean, Québec	St. John, New Brunswick
Mean	38	43
Standard deviation	6.8	7.5

- (a) Do the data provide sufficient evidence that the mean ages are different in St. Jean, Québec and St. John, New Brunswick? Test using $\alpha = 0.01$.
- (b) Find the P -value of the test in (a).
- (c) Construct a 99% confidence interval for the difference in mean ages between welfare recipients in St. Jean, Québec and St. John, New Brunswick.
- (d) If the ages of the welfare recipients were not normal, would the above statistical procedures still be valid? Explain.
2. (a) How many people should be sampled in order to estimate the proportion of those who are superstitious within 1%, with 90% confidence?
- (b) It is suspected that university students are less superstitious than the rest of the population. To estimate the difference in proportions of those who are superstitious within 1%, with 90% confidence, how many University students and how many other people should be sampled? (Assume the sample sizes are equal.)

3. The number of seeds in a randomly chosen Muscat grape has the following distribution:

number of seeds	0	1	2	3	4
probability	0.2	0.2	0.4	0.1	0.1

- (a) Given that a grape has 1 or more seeds, what is the probability that it has 4 seeds?
- (b) Find the mean and standard deviation of the number of seeds in a randomly chosen grape.
- (c) A random sample of 100 Muscat grapes is chosen, and the sample average \bar{X} is calculated. Find the mean and standard deviation of the sample average, \bar{X} .
- (d) If \bar{X} is greater than 2 seeds per grape then the grapes are crushed for juice; if not, they are sold as fresh table grapes. Find the probability that \bar{X} is greater than 2 seeds per grape.
4. In a study of a new drug, Stuffin, for stimulating appetite, 150 under-weight patients were given Stuffin and another 120 under-weight patients just sprinkled salt on their food. The number of patients who gained and lost weight after a one month trial is given in the following table:

	Stuffin	Salt
Gained weight	88	68
Lost weight	62	52

- (a) Do these results demonstrate a higher probability of weight gain with Stuffin than salt? Conduct a hypothesis test, and use $\alpha = 0.05$.
- (b) Find the P -value of the test in (a).
- (c) Construct a 95% confidence interval for the difference in the probability of weight gain between Stuffin and salt.
5. Bernoulli Airlines offers only two choices for dinner on all its flights: chicken or beef. Past experience has shown that 61% of its passengers will ask for chicken.
- (a) For the first 6 passengers, find the probability that exactly 4 will ask for chicken.
- (b) For a flight with 500 passengers, Bernoulli airlines orders 315 chicken dinners and 210 beef dinners. Find the probability that not everyone will get the dinner choice that they asked for. [Hint: this is the same as the probability that the number of passengers who ask for chicken is greater than 315 or less than $500 - 210 = 290$. Use the normal approximation.]

6. A food scientist wants to study whether quality differences exist between yogurt made from skim milk with and without the preculture of a particular type of bacteria, called Psychotrops (PC). Samples of skim milk are procured from 7 dairy farms. Half the milk sampled from each farm is inoculated with PC, and the other half is not. After yogurt is made with these milk samples, the firmness of the curd is measured:

Curd firmness	Dairy farm						
	A	B	C	D	E	F	G
With PC	68	75	62	86	52	46	72
Without PC	61	69	64	76	52	38	68

- (a) Do these data substantiate the conjecture that the treatment of PC results in a higher degree of curd firmness? Test at $\alpha = 0.05$.
- (b) State the assumptions you made about the distribution of the observations in order to answer (a).
7. Each fall, Canada geese migrate south by three different routes: east, west, and central. Of those geese who choose the eastern route, the proportion that arrive in the southern breeding grounds before Thanksgiving is 0.7. Of those who take the western route, the proportion that arrive before Thanksgiving is 0.6, and of those who take the central route, the proportion that arrive before Thanksgiving is 0.2. In the past, the proportion of geese choosing the east, west and central routes has been 0.1, 0.5 and 0.4, respectively.
- (a) What is the probability that a randomly chosen goose will arrive in the southern breeding grounds before Thanksgiving?
- (b) Given a goose does arrive before Thanksgiving, what is the probability that it took the central route?

McGILL UNIVERSITY
FACULTY OF SCIENCE

FINAL EXAMINATION

MATHEMATICS 189-203A

PRINCIPLES OF STATISTICS I

Examiner: Professor K. Worsley
Associate Examiner: Dr. F. Rouah

Date: Tuesday, December 15, 1998
Time: 9:00 A.M. - 12:00 Noon.

INSTRUCTIONS

Answer all questions.
Calculators are permitted.
Tables are provided at the end of this examination.
Students may bring into the exam a single
 $8\frac{1}{2} \times 11$ sheet of paper, written on both sides.

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