

Instructions: You may use a hand calculator. Do not hand in the question and formula sheets. Answer all **three** questions in the answer booklet provided. Show your work: incorrect answers without any work shown cannot be given partial marks. Formulas and tables are provided at the end of the question pages; you may wish to detach these from the question pages for easier reference.

1. You obtain the following sample of 10 Canadian household incomes (in thousands of dollars): 67 67 66 64 68 73 69 77 90 69

- Find the mean and median of the data.
- Find the first and third quartiles of the data.
- Find the sample standard deviation.
- The data is actually *grouped data* of mean household incomes of the 10 Canadian provinces. Calculate the mean household income of the *last four* data points—the western provinces—by also using the following population counts (in millions):

	Manitoba	Saskatchewan	Alberta	British Columbia
Household income:	69	77	90	69
Population:	1.3	1.1	3.8	4.6

2. Suppose that, in any given week, the price of gas per litre (in dollars), denoted X , is a random variable that follows a normal distribution with mean 1.2 and standard deviation 0.1.
- Suppose that it costs you \$2 worth of your time, plus the cost of the gas, to fill up your car which takes 40 litres of gas. Denote the total cost of a fill-up as Y , and write down an expression for Y in terms of X .
 - Find the mean, variance, and standard deviation of Y .
 - Find the probability that, on a random week, the cost of a fill-up (i.e. the value of Y) will be:
 - Below \$50.
 - Between \$42 and \$55.
 - Below \$42 or above \$55.
 - Exactly \$47 (assume no rounding of decimal prices).
 - A researcher obtains 25 observations of the gas price (i.e. observations of X , not of Y) and calculates the mean of those observations. Find the probability that the sample mean will be less than or equal to 1.23.

3. A researcher studying the effect of education on income collects data on whether or not the employees of a large Canadian corporation, BlueBerry, earned a university degree, and classifies the worker as having either a high-skill or low-skill job. The researcher uses a simple random sample to select 50 of the corporation's employees to interview. Of the 50 employees surveyed, 18 have university degrees. Of those 18, 14 have high-skill jobs. Of the remaining surveyed employees, 15 have high-skill jobs.
- What is the population of the sample? Will the sample be appropriate for determining the relationship between university degrees and job skill levels among all Canadian workers?
 - Form a two-way table of counts summarizing the data. Include a "Total" column and row in your table.
 - Find the distribution of the skill variable conditional on having a university degree, and, separately, the distribution of the skill variable conditional on *not* having a university degree. Based on your results, is there a relationship between having a university degree and having a high-skill job for workers of this corporation?
 - The researcher conducts the same survey at another Canadian corporation, Tom Hurten's, and estimates the following probabilities, where H indicates a high-skill job, L indicates a low-skill job, U indicates having a university education, and N indicates not having a university education:
 - $P(N \cap H) = 0.20$
 - $P(N \cap L) = 0.60$
 - $P(U \cap H) = 0.05$
 - Find $P(U \cap L)$, $P(U)$, $P(H)$, and $P(U \cup H)$.
 - Find $P(H | U)$. Are having a university degree and having a high-skill job independent? Be sure to show a condition that is satisfied or not satisfied to support your answer.