ADMS 2320 - Study Package

The following data represent the annual returns in percentages of a sample of ten stocks that traded on the Toronto Stock Exchange in 2009: 22, 30, -18, -12, 15, 19, -36, 12, 8 and 30.

Compute the following statistical measures:

Mean, Median, Mode, Variance, Standard Deviation, Coefficient of Variation, MAD, 34^{th} percentile.

Example A retailer wanted to estimate the monthly fixed and variable selling expense. As a first step, she collected data from past 8 months. The total selling expense ($1,000) and the total sales ($1,000) were recorded and listed below. (Please use the table below to do calculation for parts b, c, and e)

Total Sales	Selling Expenses				
20	14				
40	16				
60	18				
50	17				
50	18				
55	18				
60	18				
70	20				

a) Compute the median of the total sales. (Please make sure that you have read the instruction on the top of the page)
b) Compute the standard deviation of the total sales.
c) Compute the standard deviation of the selling expenses.
d) Compute the 60th percentile of the total sales.
e) Compute the covariance.
f) Compute the coefficient of correlation.

Example Psychologists tend to believe that there is a relationship between aggressiveness and order of birth. To test his belief, a psychologist chose 500 elementary school students at random and administered each a test designed to measure the student's aggressiveness. Each student was classified according to one of the four categories. The percentages of students falling into four categories are:

	Firstborn	Not Firstborn
Aggressive	15%	15%
Not Aggressive	25%	45%

a) If a student is chosen at random from the 500, what is the probability that the student is first born?

b) What is the probability that the student is aggressive?

c) What is the probability that the student is aggressive given that the student was first born?

d) Are the events 'student chosen is aggressive' and 'student chosen is first born' independent?

e) If five students are chosen at random, what is the probability they are all aggressive?

Example There have been major changes in the minor hockey league as of late due to the reassignment of geographical territories which ultimately impacts where those players play. When a minor league hockey player is reassigned to a new team, they are supposed to be trained by the coach directly. However, due to their busy road trips and coach conferences, 76% of new players are given the play book to read and learn themselves. This also indicates that 24% of new players are getting the training directly from the coach. 81% of players that received the proper training from the coach perform exceptional within a season; whereas only 25% of players left to rely on the play book manual perform exceptional within a season. (Note: keep 4 decimal places if necessary.)

a. What is the probability that a player is not performing exceptional within a season?

b. What is the probability that a player is performing exceptional with a season and did so by learning the responsibilities through the play book?

c. What is the probability that a player is not performing exceptional within a season or was shown the position responsibilities through reading the play book?

d. A player is not performing exceptional within a season. What is the probability that they were trained by the coach?

e. Is player performance independent of the way the player was trained for the new position? Demonstrate with probabilities.

Example A standard admissions test was given at three locations. One thousand students took the test at location Toronto East, 700 students at location Toronto West, and 300 students at location Toronto Central. The percentages of students from locations Toronto East, Toronto West, and Toronto Central, who passed the test were 70%, 68%, 77%, respectively. One student is selected at random from among those who took the test. Find the following probabilities:

1. What is the probability that the selected student passed the test?
2. If the selected student passed the test, what is the probability that the student took the test at location Toronto East?
3. What is the probability that the selected student took the test at location Toronto Central and failed?
4. What is the probability that the selected student failed the test?
5. If the selected student failed the test, what is the probability that the student took the test at location Toronto West?

Example An auto insurance company studied data on its automobiles accidents and determined that 0.04% of drivers were involved in at least one accident during a year. To promote the safe driving and potentially reduce the accident rate, the company decided to introduce the new Telematics mobile app program. The Telematics mobile app can be downloaded and installed on a smart phone. The Telematics app is an interactive tool that allows you to analyze and improve your driving habit and then rewards you with savings on your auto insurance premium renewal.

One year after introducing the telematic app, the company found that 70% of the drivers involved in accidents did not have the Telematics mobile app. In addition, 80% of the drivers who were not involved in any accidents have the Telematic mobile app installed.

a) Construct either a 2-way probability table or probability tree of this problem.

b) What is the probability that a driver was involved in at least an accident and did not have the Telematics mobile app last year.

c) What is the probability that a driver was not involve in any accident or had the Telematics mobile app installed last year?

d) Does a driver who has the Telematics mobile app have a higher probability of being involved in accidents? Yes or No and support your answer quantitatively below.

e) What is the probability that a driver who does not have the Telematics mobile app will not be involved in any accident in a year.

Example Giraffe Food & Beverage is a family-owned and operated manufacturing company specializing in the creation and production of delicious products for the Foodservice industry in the GTA. Giraffe gets the lids for its sauce's jars from two suppliers, fifty five percent from Ball Corporation and the rest from Sunny Glassware. Due to different manufacturing techniques, the defect rates of the two suppliers are different, 3 out of 100 lids that came from Ball Corporation are defective. Giraffe Food & Beverage production manager noticed that 3.45% of all lids are defective.

1) What is the Probability that a lid is not defective and came from Sunny Glassware?
2) What is the probability that a lid is defective and came from Ball Corporation?
3) What is the probability that a lid is defective or came from Sunny Glassware?
4) A customer bought a BBQ sauce jar with a defective lid. What is the probability that it came from Sunny Glassware?
5) Is the defect rate independent of the supplier? Demonstrate your answer with probabilities.

Example A study had found that 20% of all female (F) university students smoke (S). This compares to another study showing that 40% of all university students smoke. Suppose that at a particular university, females are 55% of the students enrolled.

1. What is the probability that a student chosen at random is not a female and smokes?
2. What is the probability that a student chosen at random does not smoke, given that they are a not female?
3. What is the probability that a student that is smoking is a female student?
4. What is the probability that a student chosen at random is a female or smokes?
5. What is the probability that a non-female student chosen at random is a smoker?
6. A saliva test confirms that a student is not a smoker. What is the probability that the student is not female?
7. Is smoking independent of gender? Support your answer appropriately.

Example There is increasing awareness that entrepreneurship is growing not only in importance to the overall economy but in its importance to students graduating from university who are increasingly looking at entrepreneurship as a career choice. Today nimble entrepreneurial firms recognize opportunities early and leverage their intellect, their skills and technology. One criticism and myth of entrepreneurship is that the vast majority of new businesses fail. This simply isn't true. The often-used statistics that 9 out of 10 businesses fail in their first few years is an exaggeration (after all, why let facts stand in the way of a good urban legend). One success factor is believed to be the entrepreneur's level of experience in the industry sector in which they're looking to open a business. It has been claimed that to become truly competent and proficient in any given field takes on average 10,000 hours of experience. The following data has been gathered to examine these claims. 22% of new entrepreneurs had met the experience 'requirement'. 42% of businesses that failed in their first 3 ½ years hadn't met this 10,000-hour threshold, while only 17% of businesses that did meet the 10,000 hour threshold failed.

1. What is the probability that a business was not a failure?

2. If it was not a failure, what is the probability it met the 10,000-hour threshold?

3. What percentage of businesses were classified as failures?

4. If it was a failure what is the probability it met the 10,000-hour threshold?

Example Daffodils Insurance Company has created a new policy for the coming year. Before offering potential customers the new rates, Daffodils insurance company has collected the following data on the gender and marital status of 400 current customers:

- 50 customers are male and single
- 31.25% customers are single
- 235 customers are male
- 60 customers are male and divorced
- 43.75% are married customers
- 41.25% are female customers

Based on the above information, create a contingency table and answer the following questions if a customer is selected at random.

A) Find the probability that the customer selected is a married female
B) Find the probability that the customer selected is single
C) Find the probability that the customer selected is female or divorced
D) Find the proportion that the customer selected is married if the customer is male
E) Is marital status independent of gender? Explain using probabilities.

Insurance companies collect data to determine what rate to charge clients.
The table below lists the number of automobiles insured for a given model year, and the number of cars that were involved in an accident for a given model year.

Model Year	Numbers of Insured Automobiles	Number of Automobiles involved in an accident
Older Model Year	15210	73
2014	5408	19
2015	6084	18
2016	7098	32

A) What is the probability a randomly selected vehicle got in to an accident?
B) What is the probability that a 2016 model year vehicle got in to an accident?
C) What is the probability that a randomly selected vehicle is from 2014 and was not in an accident?
D) What is the probability that a vehicle is an older then 2014 or was in an accident?