ADM 2304 – ASSIGNMENT 1 (35 marks)

Due date: Sunday, February 2 2020 at 11:59 pm.

Instructions:

- *You may use MS Excel or other software for any calculations. However, you must show your manual calculations when asked. You may paste your output onto your assignment to show your use of software; however, this output does not replace any of the steps outlined below. This means that answers that are exclusively software output may receive only partial marks.*
- *If you are performing a hypothesis test, make sure you state the hypotheses, the level of significance, the rejection region, the test statistic (and/or p-value, if requested), your decision (whether to reject or not to reject the null hypothesis), and a conclusion in managerial terms that answers the question posed. These steps must be completed in addition to any software output.*
- *The data for this homework assignment can be found in the file* ***Assign1Data.xlsx****.*
- *Your assignment must be typed and uploaded to Brightspace in one pdf file. You may upload several files, but only the most recent submission prior to the deadline will be graded.*
- *Late submissions will be accepted only until Tuesday, February 4 at 11:59 pm, unless permission to be submitted late is granted by your instructor. A penalty of 3.5 marks will be deducted for each 12-hour delay or part thereof.*
- *Remember to include your integrity statement.*

Question 1 – 2019 Canadian Federal Election (3 questions – 10 marks)

In the 2019 Canadian Federal Election, 34.41% of the electorate voted for the Conservative party, 33.07% for the Liberal party, 15.93% for the NDP, 7.69% for the Bloc Québécois, 6.50% for the Green party, and 1.64% for the People's party.

a) **[4 marks]** A recent poll of 1,500 respondents found that 31.82% support the Conservative party. Test whether this is sufficient evidence to conclude that the level of support for the Conservative party has dropped since the election. Use a 2% level of significance and show your manual calculations.

b) **[2 marks]** Suppose you want to estimate the national level of support for the Conservatives using a 98% 2-sided confidence interval with a margin of error of 1%. What sample size would be required?

c) **[4 marks]** Suppose that, in a random sample of 25 University of Ottawa (uOttawa) students, only 4 indicated a preference for the Conservatives. Test whether this is sufficient evidence to indicate that the level of support for the Conservatives among uOttawa students is lower than the 34.41% share of the popular vote in 2019. Use a 2% level of significance and show how you would calculate the *p*-value for this test.

Question 2 – Key Incentives (4 questions – 10 marks)

Different kinds of companies compensate their key employees in different ways. Established companies may pay higher salaries, while new companies may offer stock options that will be valuable if the company succeeds. Do high-tech companies tend to offer stock options more often than other companies? One study looked at a random sample of 200 companies. Of these, 91 were listed in the Directory of Public High Technology Corporations and 109 were not listed. Treat these two groups as SRSs of high-tech and non-high-tech companies. Seventy-three of the high-tech companies and 75 of the non-high-tech companies offered incentive stock options to key employees.

a) **[5 marks]** Test whether these two types of companies are equally likely to offer this kind of benefit to their employees. Use the critical value approach and a 0.05 level of significance. Perform the test manually.

b) **[1 mark]** Explain how to find the *p*-value manually (i.e., indicate what probability has to be calculated).

c) **[2 marks]** Finally, compute manually the 95% 2-sided confidence interval for the true difference between the proportions of high-tech and non-high-tech companies that offer incentive stock options to key employees.

d) **[2 marks]** Explain how the results you obtained in parts b) and c) are consistent with your conclusion in part a).

Question 3 – Real Estate (7 questions – 15 marks)

The data set **RealEState** contains information on the listings of 1,047 real estate properties.

a) **[1 mark]** Treating this data set as the population, use MS Excel to calculate the population mean for the **Price** variable. Report this value and set it aside until part e).

b) **[2 marks]** Examine a boxplot and a histogram of the **Price** variable. Display these two plots and explain if the means of all possible random samples of size 40 from this population would form a normal distribution.

Answer parts c) and d) without information from parts a) and b).

c) **[3 marks]** Now use MS Excel ToolPak to draw twenty samples of size n = 40 from the **Price** population. For each sample, use MS Excel to calculate a 95% confidence interval estimate for the population mean, assuming you do not know the population standard deviation. Report only the confidence interval for each sample.

d) **[3 marks]** For your first sample, calculate the interval manually. Display the sample data using a boxplot and comment on whether the relevant assumption regarding the population distribution is warranted given your sample (state clearly the assumption

needed to justify the interval estimation). Do not display the actual data values only the graph.

e) **[1 mark]** Count the number of confidence intervals out of your twenty that contain the true value of the population mean from part a). Explain if this value is consistent with the confidence level specified in part c).

From the data set, select a new sample of 50 listings from houses with fireplaces (variable **Fireplace** = 1). Make your random selection by taking the observations with the 50 lowest random numbers in Column I (**Random #**).

f) **[4 marks]** Test at the 1% level of significance whether the sample of houses with fireplaces is enough to show that the mean price of houses with fireplaces exceeds $163,800. Show your manual calculations (use MS Excel to summarize the sample data).

g) **[1 mark]** Display the new sample data (**Price** variable) using a boxplot and explain whether your test satisfies the underlying assumptions, with reference to this boxplot.