1. Eighty-five percent of Canadians receive their high school diploma. A group of 10 Canadians will be sampled. What is the probability that

    a) All 10 have their high school diploma?   (2)

    b) At most 8 have their high school diploma?   (3)

    c) Among the 10, how many should we expect to have their high school diploma?   (1)

    d) What is the standard deviation in this number?   (1)

2. It is known that 96% of Wikipedia users do not donate. Two hundred JAC students use Wikipedia Sunday morning between 9am and 10 am. What is the approximate probability that at least 190 of them do not donate? Check and show that this approximation is justified.   (3)

3. The Wechsler Adult Intelligence scale (WAIS) is a commonly used IQ test. The WAIS for the general population is approximately normal with mean 100 and standard deviation 15.

    a) What percentage of the people in the general population have scores below 120?   (2)

    b) MENSA is an elite group. They distinguish themselves by having the highest 10% IQ scores. Above what score does one need to be a member of MENSA?   (3)

    c) What is the probability that the mean WAIS score of a group of 16 JAC students will be greater than 110?   (3)

4. Starting salaries of 115 college graduates who have taken a statistics course have a mean of

$42 293. Suppose the distribution of this population is approximately normally distributed and has a standard deviation of $8 832.

    a) Find a 90% confidence interval for the true population mean.   (4)

    b) Write a sentence interpreting the interval found in part 'a'.   (1)

    c) Without actually finding it, would an 80% confidence interval be wider or narrower? Justify.   (1)

    d) If we want to keep a 90% confidence level but limit the error to $1000, at least how many college graduates should be sampled?   (4)

5. How much money do winners go home with from the television quiz show *Jeopardy*? To determine an answer, a random sample of 15 winners was found to have an average of $32 777.67 and a standard deviation of $5874.28. Assume the distribution of winnings is approximately normal.

    a) Estimate with 90% confidence the mean winnings for all the show's players.   (4)

    b) The promoter of the show claims that the average amount that winners go home with at least $38 000. Test this claim at the $\alpha=0.01$ level of significance.   (5)

6. A government official is in charge of allocating social programs throughout the city of Vancouver. He will decide where these social outreach programs should be located based on the percentage of residents living below the poverty line in each region of the city. He takes a simple random sample of 121 people living in Gastown and finds that 23 have an annual income that is below the poverty line.

    a) Use this sample data to compute a 95% confidence interval for the true proportion of Gastown residents living below the poverty line.   (4)

    b) The official wants to limit the width of the interval to 0.1 (so the error would be 0.05) in a 90% confidence interval, how many residents should be sampled?   (4)

    c) Test the hypothesis at the $\alpha=0.01$ level of significance that the true proportion living below the poverty line differs from 25%.   (5)

Answers to Advanced QM December 2020 Final:

1a) 0.1969   b) 0.4557   c)9 Students   d)1.129

2.   0.8159   3a) 90.82%   b) Above 119.275   c) 0.0038

4a) 40 938.2<mu<43 647.8   c) Narrower   d) At least 212

5) 30 106.7<mu<35 448.64   b) t*=-3.44, t=-2.624, reject Ho

6) 0.1202<p<0.25998 b) At least 167residents

c) z*=-1.522, z=± 2.58, do not reject Ho