1. Conceptual Questions
   1. (2 marks) Clearly define the significance level of a hypothesis test.
   2. (2 marks) What are the 2 ways we can decrease the width of a confidence

interval?

* 1. (2 marks) State the Central Limit Theorem
  2. (2 marks) What is the difference between a parameter and a statistic
  3. (2 marks) When can we make causal claims based on a statistical study?

1. According to Petbacker.com, 37% of Canadian households own at least 1 cat. Hence, it is reasonable to assume that a randomly selected household has a 0.37 probability of having at least 1 cat. Suppose John obtains a random sample of 10 Canadian households and, given the large number of Canadian households, it is reasonable to assume the households in John’s sample are independent of one- another.
   1. (1 mark) What is the expected number of households that own at least 1 cat?
   2. (2 marks) What is the standard deviation for the number of households that own at least 1 cat?
   3. (2 marks) Give a simple interpretation of your answers from (a) and (b)
   4. (3 marks) What is the probability that the number of households with at

least 1 cat is at least 3 but at most 5

* 1. (3 marks) What is the probability that at least 2 of the households in

John’s sample have at least 1 cat?

1. In 1905, a study found that the brain weights of Swedish men are approximately normally distributed with a mean of 1.40 kg and a standard deviation of 0.11kg.
   1. (3 marks) What is the probability that a randomly selected Swedish man

has a brain that weighs less than 1.25 kg?

* 1. (3 marks) What is the 90th percentile of Brain weights for Swedish men?
  2. (4 marks) Suppose a random sample of 4 Swedish men is to be obtained.

What is the probability that their average brain weight is between 1.35 kg and 1.45kg?

1. A typical housecat sleeps 18 hours per day. John wishes to estimate the average amount of sleep obtained by Ellie (the older of his two cats). John records the number of hours Ellie spends sleeping each day, over the course of a 30-day period. On average, Ellie slept 19 hours per day with a standard deviation of 2 hours, and the distribution of her hours of sleep was strongly skewed to the left.
   1. (3 marks) Compute a 90% confidence interval for the mean number of hours Ellie sleeps in a day.
   2. (2 mark) Does the interval obtained in (a) provide evidence to suggest that the Ellies’s average hours of daily sleep differs from that of a typical housecat? Explain briefly.
   3. (2 marks) Do you feel it is reasonable to make inferences based off of the interval in (a)? Specifically, are there any obvious threats to the assumptions needed for this interval to be valid?
2. John suspects that students who wear glasses tend to finish exams faster than students without glasses. In order to test this claim, John records the average and standard deviation for the minutes taken to complete an exam in his Stat 151 class.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Sample Size | Average | Standard Deviation |
| Glasses | 16 | 41.4 | 4 |
| No Glasses | 64 | 45.4 | 13.86 |

* 1. (8 marks) Does the above data provide sufficient evidence to suggest that the Stat 151 students with glasses write exams faster than those without glasses? Test at a significance level of α=0.05.
  2. (2 marks) Can John claim that these results apply to all individuals? Explain.

1. According to data released by Statistics Canada. In both 2006 and 2011, the percentage of individuals who are fluent in French is greater among individuals living B.C. than those living in Alberta. Specifically, in 2006, 7.3% of the B.C. population was fluent in French vs 6.9% in Alberta; in 2011 6.9% in B.C. vs 6.6% in Alberta.

A researcher is interested in testing whether this trend has persisted into present times. Thus, the researcher collects a random sample of 500 individuals from B.C. and a random sample of 500 individuals from Alberta. 35 of the individuals in the B.C. sample report that they are fluent in French, while only 30 of the individuals in the Alberta sample report that they are fluent in French.

* 1. (8 marks) Does this provide evidence that the proportion of French speakers in B.C. is greater than that of Alberta? Test at a 10% significance level.
  2. (2 marks) Are there any threats to the assumptions needed for this test to be valid? Explain.

1. A horribly jaded statistics instructor is interested in comparing Canadian politicians to U.S. politicians. The instructor collects a random sample consisting of 30 Canadian politicians and 70 U.S. Politicians, and he classifies each politician as one of the following: Liar, Thief, Idiot, Scoundrel. The data are summarized in the following 2-way table.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Liar | Thief | Idiot | Scoundrel | Total |
| U.S | 20 | 35 | 10 | 5 | 70 |
| Canada | 5 | 7 | 15 | 3 | 30 |
| Total | 25 | 42 | 25 | 8 | 100 |

Do the data provide evidence of a difference in proportions of politician classification between the U.S. and Canada?

1. a)  (8 marks) Test at a significance level of 1%
2. b)  (2 mark) Is there anything that makes the above test be invalid?