# ISyE 3770 Assignment 6: Confidence Intervals

*Due date: 11:59 PM, Tuesday, April 9, 2024.*

**Question 1** (Mean Confidence Interval Estimation)**.** *An article in the Journal of Agricultural Science investigated means of wheat grain crude protein content (CP) and Hagberg falling number (HFN) surveyed in the UK. The analysis used a variety of nitrogen fertilizer applications (kg N/ha), temperature ($^\circ C$), and total monthly rainfall (mm). The data below describe temperatures for wheat grown at Harper Adams Agricultural College between 1982 and 1993. The temperatures measured in June were obtained as follows.*

`15.2, 14.2, 14.0, 12.2, 14.4, 12.5, 14.3, 14.2, 13.5, 11.8, 15.2.`

*Let us assume the population temperature distribution is normal, with standard deviation* $\sigma = 0.5$.

1) *Construct a* $99\%$ *two-sided confidence interval on the mean temperature.* *(20 points)*
2) *Construct a* $95\%$ *lower-confidence bound on the mean temperature.* *(10 points)*
3) *Suppose we wanted to be* $95\%$ *confident that the error in estimating the mean temperature is less than* $2$ *degrees Celsius. What sample size should be used?* *(20 points)*

**Question 2** (Standard Deviation Confidence Interval Estimation)**.** *A healthcare provider monitors the number of CAT scans performed each month in each of its clinics. The most recent year of data for a particular clinic are as follows (the reported variable is the number of CT scans each month expressed as the number of CT scans per thousand members of the health plan):*

`2.31, 2.09, 2.36, 1.95, 1.98, 2.25, 2.16, 2.07, 1.88, 1.94, 1.97, 2.02.`

*Let us assume the number of CT scans per month follows normal distriution. Find a two-sided* $95\%$ *confidence interval for the standard deviation.* *(20 points)*

**Question 3** (Proportion Parameter Confidence Interval Estimation)**.** *A CNN/ORC Poll conducted in Jan. 2014, asked the following question: Do you think the use of marijuana should be made legal, or not?. See the following website for details: http://www.pollingreport.com/drugs.htm.*

1) *Based on the Poll's results (see the figure below for details), calculate a* $95\%$ *confidence interval for* $p$*, the proportion of all American adults who oppose the legalization, and interpret your interval in context. (Hint: One way to deal with the unsure votes is to combine them with the ones who think legalization is a good idea, thus making the vote have only two options: oppose the legalization and others.)* *(20 points)*

**NPR/PBS NewsHour/Marist Poll**. July 15-17, 2019. N=1,346 adults nationwide. Margin of error ± 3.5.

**"Do you think legalizing marijuana nationally is a good idea or a bad idea?"**

| | A good idea % | A bad idea % | Unsure % |
|---|---|---|---|
| 7/15-17/19 | 63 | 32 | 5 |

2) *The report provides the information that the margin of error equals* $\pm 3.5$ *(note that it says in blue above the results, "Margin of error* $\pm 3.5$*"). Write one or two brief sentences interpreting this value that could be understood by someone who does not know anything about statistics.* *(10 points)*