

## Homework 08: Due 11/8

Stat061-F23

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1. Evaluate the integral  $\int_0^\infty \frac{1}{1+x^2} dx$  using the t distribution.
2. Recall in HW7 we dealt with the following setup:

For  $n = 64$  female subjects, the average temperature was  $\bar{X} = 98.36$  with a sample standard deviation of  $s = 0.68$ . There were 24 women with temperatures of 98.6 or higher. Assume this is a representative sample and we can invoke the CLT.

Now, find a 95% and 99%  $\mu$  using  $s$ , and compare your answers to HW7 which used  $\sigma$ .

3. A *Cauchy* random variable is a t-distributed random variable with  $df = 1$ .
  - (a) Let  $Y \sim \text{Cauchy}$ . From the definition of a t-distribution, show that  $Y$  can be expressed as a ratio of two independent standard normal variables.
  - (b) Simulate  $n = 1, 10, 100, 1000, 10000, 100000, 1000000$  Cauchy random variables (use `?rcauchy` for tips) and find the sample mean for each. Does the sample mean seem to be converging as the law of large numbers predicts?
  - (c) Run `summary()` on your  $n = 1000000$  sample. Do the median and quantiles seem to be converging to the expected values?
4. TBA