

Homework 1: Due on Feb. 3

Guideline

- Homework should be submitted via Gradescope by Friday midnight (11:59 pm. CDT).
- Homework answers to Simulations and data analysis should be written in R Markdown.
- Please find the following exercise question in [HMC] (Hogg, Mckean, and Craig 2018).
- Each question is worth of 10 points and the total is 50 points.

1. Ex 4.1.2

(a) To overlay the histogram and density estimates, use the code

```
hist(x,pr=T)
```

```
lines(density(x))
```

where the R vector x contains the data.

2. Ex 4.2.9

Please use Monte Carlo simulations of size 1000 to answer this question. Set $\mu = 1$ and $\sigma^2 = 1$. Hint: Ex 4.2.11 provides some useful R codes.

3. Continue with the previous question.

(a) Please compare the coverage probability (the number of confidence intervals among 1000 CIs that contain the true mean) of the z-confidence interval and that of the t-confidence interval. Do they both agree with the nominal coverage probability 95%?

(b) Reconstruct the z- confidence intervals using the sample standard deviation instead of the true standard deviation. What is the the coverage probability now? How does it compare with the above two types of confidence intervals?

Hint: Ex 4.2.11 provides some useful R codes.

4. Comparison of z- and t-confidence intervals for one sample proportion.

(a) Please simulate 1000 random samples of size 30 from Bernoulli trials with probability 0.5. Estimate the sample proportions and construct 95% z-confidence intervals.

```
rbinom(1000,size=30,p=0.5)
```

(b) Please use the above samples to also construct 95% t-confidence intervals.

(c) Compare the confidence intervals in part (a) and part (b) in terms of length and coverage probability.

5. Ex 4.2.10