Lab 4: Sampling distribution

Not graded, just practice

Katie Schuler

2024-09-19

Practice your new stats skills with these practice exam questions! Best to open a fresh Google Colab notebook and test things out! Refer to the study guide to find answers as well.

> 💡 Tip
>
> More than one answer may be correct!

If you would like to practice with a set of data, you can import the following dataset with `read_csv`:

```
# brain volumes simulated from Ritchie et al
"http://kathrynschuler.com/datasets/brain_volume.csv"
```

0.1 Exploring a simple dataset

(a) Which of the following is the best choice to visualize the frequency distribution of a set of data? Choose one.

- (A) `geom_rug()`
- (B) `geom_histogram()`
- (C) `geom_point()`
- (D) `geom_smooth()`

(b) Which of the following would summarize the central tendency of a set of data? Choose all that apply.

- (A) mean
- (B) median
- (C) standard deviation
- (D) inter quartile range (IQR)

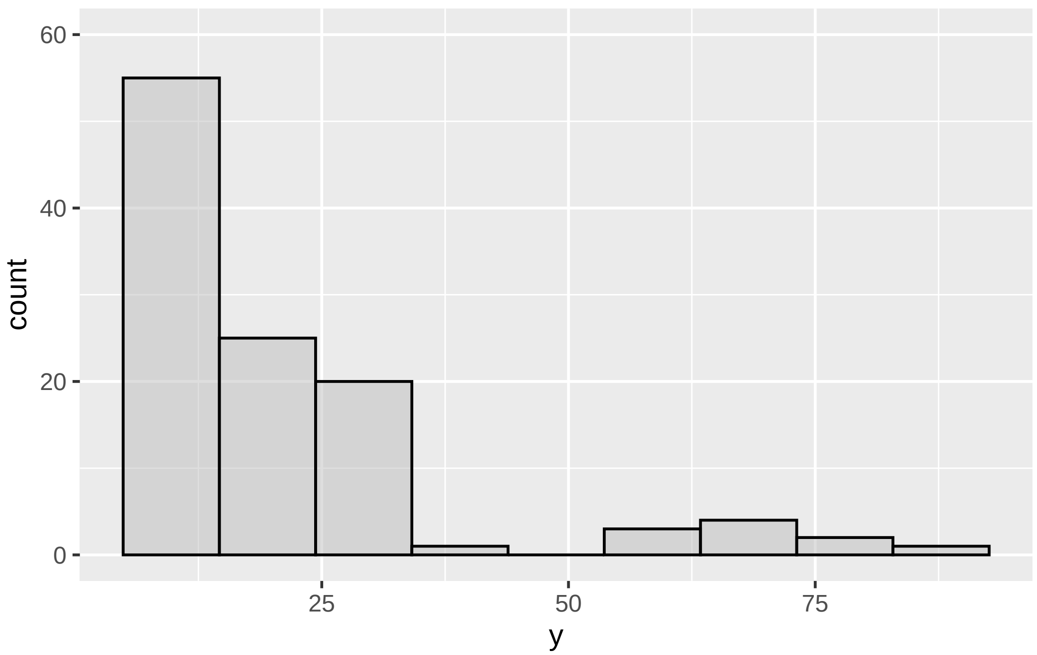
(c) Which of the following would summarize the spread of a set of data? Choose all that apply

- (A) mean
- (B) median
- (C) standard deviation
- (D) inter quartile range (IQR)

(d) Which of the following are paramteric statistics?

- (A) mean
- (B) median
- (C) standard deviation
- (D) inter quartile range (IQR)

(e) Given the following figure, which summary statistics would best describe these data?



- (A) mean
- (B) median
- (C) standard deviation
- (D) inter quartile range (IQR)

(f) Given the following code, which of the following would fill in the blank to return the value below which 20% of the data fall.

```
data %>% summarise(
    lower = quantile(y, ________)
)
```

- (A) 20
- (B) -20
- (C) below
- (D) 0.2

0.2 Probability distributions

(a) Write code to generate 200 data points, sampled from a gaussian distribution with a mean of 0 and a standard deviation of 1.

```
rnorm(200, mean = 0, sd = 1)
```

(b) Suppose you sampled 500 data points from a uniform distribution and stored the result in `data`. Then, you use the following code to compute the summary stats. What is the height of the probability density function at a value of 5?

```
data %>% summarise(
    n = n(),
    mean = mean(y),
    sd = sd(y),
    lower = quantile(y, 0),
    upper = quantile(y, 1)
)
```

```
# A tibble: 1 x 5
      n  mean    sd lower upper
  <int> <dbl> <dbl> <dbl> <dbl>
1   500  7.56  1.42  5.02  9.97
```

—

(c) Suppose your data is normally distributed and has a mean of 25 and a standard deviation of 5. What is the probability a random value drawn from your dataset will be less than 20? Select the closest value.

- (A) 0.0483
- (B) 0.1589
- (C) 1
- (D) 0

0.3 Sampling variability

(a) True or false, the `parameter` is the mean of the population and the `parameter estimate` is the mean of your sample?

- (A) TRUE

- (B) FALSE

(b) What do we call the probability distribution of the values our parameter estimate can take on?

____

(c) Suppose we want to quantify the spread of the sampling distribution. What method could we choose? Choose all that apply.

- (A) mean

- (B) median

- (C) standard error

- (D) confidence interval

(d) For a typical experiment, how many samples from the population is practical for us to take? Enter a number.

__

0.4 Bootstrapping

(a) True or false, when we generate the bootstrap sampling distribution, we sample our original sample *with replacement*.

- (A) TRUE

- (B) FALSE

(b) Suppose we want to generate the bootstrap sampling distribution for the mean of set of data, `data`, with one variable: `reaction_time`. Write code that uses the `infer` package to accomplish this, generating 1000 samples.

```
data %>%
    specify(response = reaction_time) %>%
    generate(reps = 1000, type = "bootstrap") %>%
    calculate(stat = "mean")
```

(c) Suppose we store our bootstrap sampling distribution from part b in a variable called `bootstrap_distribution`. Which two arguments should we add to the code below to compute the 68% confidence interval and assign it to the value `ci`?

```
ci <- bootstrap_distribution %>%
    get_confidence_interval(______, ________)
```

- (A) `type="se", level = 68`
- (B) `type="se", level = 0.68`
- (C) `type="percentage", level = 0.68`
- (D) `type="percentage", level = 68`

(d) Suppose we store our bootstrap sampling distribution in `bootstrap_distribution` and we want to visualize the confidence interval we just computed in c. Which of the following could we add to the code below? Choose all that apply.

```
bootstrap_distribution %>%
    visualize() +
    _____________
```

- (A) `get_confidence_interval(endpoints = ci)`
- (B) `shade_ci(endpoints = ci)`
- (C) `shade_confidence_interval(endpoints = ci)`
- (D) `get_ci(endpoints = ci)`