University of Texas at Austin, Department of Mathematics
M358K - Applied Statistics

The Mock In-term One

Problem 1.1. (5 points) What is the **R** output of the following command:
```
>pbinom(2,4,0.5)
```

(a) 0.375

(b) 0.5

(c) 0.6875

(d) 0.75

(e) None of the above.

Problem 1.2. (5 points) Consider the following charts, focusing on the bar graph on the right-hand side, and choose which of the offered statements is **correct**.
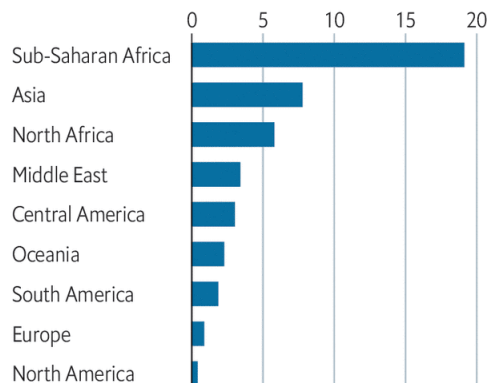
Send me your better-off...
Tourist visa costs, by region

Source: "Assessing Visa Costs on a Global Scale", by E. Recchi et al., EUI Working Paper, 2020

The Economist

(a) The shortest number of work days needed to purchase a visa is for Europe.

(b) The more affluent the region, the longer one needs to work to purchase the visa.

(c) One has to work more than three times as long in Sub-Saharan Africa than in the Middle East to purchase a visa.

(d) One has to work longer in Oceania than in Asia to purchase a visa.

(e) None of the above.

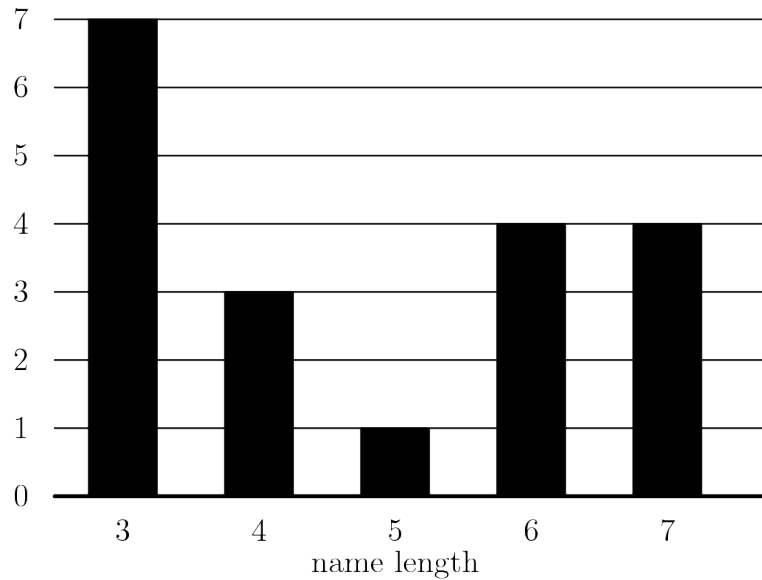**Problem 1.3.** (5 points) Consider the following histogram:
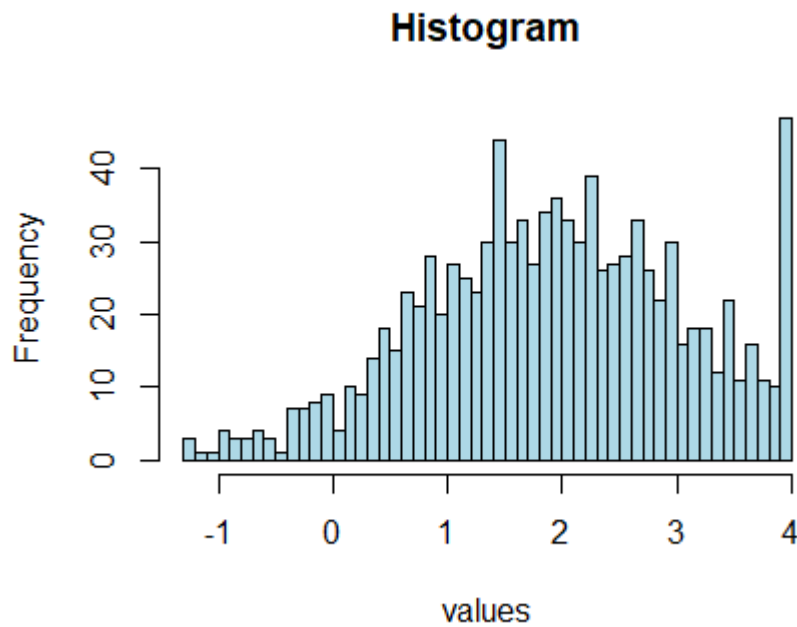
The histogram is ...

  (a) ...unimodal.

  (b) ...left–skewed.

  (c) ...right–skewed.

  (d) ...symmetric.

  (e) None of the above.

Problem 1.4. (5 points) *Source: AMC8, 2016.* The following bar graph represents the length (in letters) of the names of 19 people. What is the median length of these names?

frequency

(a) 3

(b) 4

(c) 5

(d) 6

(e) None of the above.

Problem 1.5. (5 points) Which one of the following statements is **false**?

(a) The observed sample variance is more sensitive than the sample average to a few observations with extreme values.

(b) The observed sample variance is equal to zero if and only if all of the observations are identical.

(c) When all observations are multiplied by a constant $\kappa \neq 0$, the IQR increases by $|\kappa|$.

(d) When all the observations are increased by 5, the IQR increases by 5.

(e) None of the above.

Problem 1.6. (5 points) Consider the following box plot:
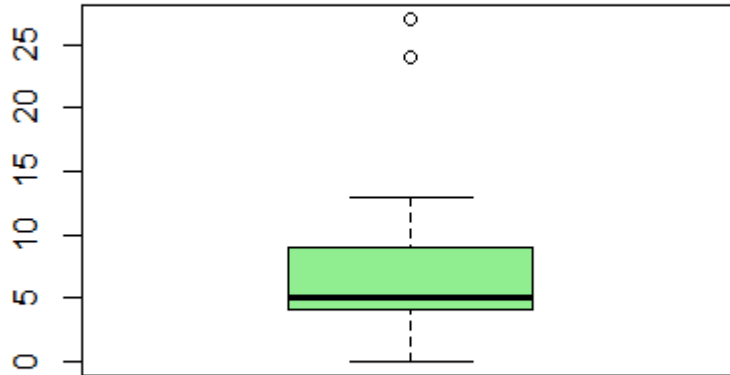
Which summary statistics does it correspond to?

(a) Min=0.000, Q1=0.000, median=5.000, mean=7.103, Q3=9.000, Max=27.000

(b) Min=0.000, Q1=0.000, median=5.000, mean=7.103, Q3=12.500, Max=27.000

(c) Min=0.000, Q1=4.000, median=7.103, mean=5.000, Q3=9.000, Max=27.000

(d) Min=0.000, Q1=4.000, median=5.000, mean=7.103, Q3=9.000, Max=27.000

(e) None of the above.

Problem 1.7. (5 points) Ahead of the school year, the KMS Functional-Fitness coach plans to track the progress of her students. She will record the number of jumping jacks her students can make before collapsing on a weekly basis. What kind of a procedure is this?

(a) A prospective observational study.

(b) A retrospective observational study.

(c) An experiment.

(d) A survey.

(e) None of the above.

Problem 1.8. (5 points) **Post-It Thievery!**

Chris P. Bacon, the office manager at a large temp agency wants to figure out what proportion of his workforce has been pilfering Post-Its. Realizing the issues with conducting a survey which outright asks: *"Have you ever committed unauthorized removal of Post-Its from the premises?"*, he decides to use the randomized-response method.

He prompts a computer to display the question

<p style="text-align:center">*"Have you ever taken a Post-It home?"*</p>

with probability 0.75. The rest of the time, a virtual fair coin is flipped on the screen and the subject is asked

<p style="text-align:center">*"Is the outcome heads?"*</p>

In both cases, the subject is prompted to click the button with **Yes** or **No**. The interviewer did not know the actual question asked, just the ultimate response. So, there was no real reason for the subject to lie, and we assume that the subjects responded truthfully.

It turned out that 80% of the subjects answered "yes". Give an estimate of the proportion of *Post-It thieves* in this population.

   (a) 0.75

   (b) 0.8

   (c) 0.85

   (d) 0.9

   (e) None of the above.

Problem 1.9. (5 points) There are three variants of a genetic marker for *goosepox*: **immune, middling,** and **susceptible**. In the population, 10% are **immune**, 70% are **middling**, and 20% are **susceptible**. Within each category, here are the chances of contracting *goosepox*:

- for **immune** it is 0%,
- for **middling** it is 50%, and
- for **susceptible** it is 90%.

Say that you learn that a randomly chosen individual contracted *goosepox*. What is the probability that this individual was **susceptible**?

   (a) 0.18

   (b) 0.34

   (c) 0.53

   (d) 0.9

   (e) None of the above

Problem 1.10. (5 points) A piggy bank contains coins of three different types: T_1, T_2 and T_3.

There are twice as many type T_1 coins as type T_2 coins, and twice as many type T_2 coins as type T_3 coins. The coins are indistinguishable to touch.

Coins of type T_1 are fair, coins of type T_2 come up heads (H) when tossed with probability 3/10, and coins of type T_3 come up heads (H) when tossed with probability 1/10.

A coin is drawn from the piggy bank at random and tossed. What is the probability that the result of the coin toss was heads?

    (a) 1/5

    (b) 17/60

    (c) 27/70

    (d) 1/2

    (e) None of the above.

Problem 1.11. (5 points) In Country X, the latest census has revealed the following:

- 40% of the population exercise regularly,
- 30% own a dog,
- 20% like cauliflower,
- 60% of all dog owners exercise regularly,
- 10% own a dog and like cauliflower,
- 4% exercise regularly, own a dog and like cauliflower.

A person is selected at random. Compute the probability that they are a dog owner who does not exercise regularly.

    (a) 0.12

    (b) 0.14

    (c) 0.16

    (d) 0.18

    (e) None of the above.

Problem 1.12. (5 points) Two coins are tossed. If E_1 is the event "heads on first coin", E_2 the event "head on the second coin", and E_3 the event "the coins match; both are heads or tails". Which of the following statement is **not** true?

    (a): E_1 and E_2 are independent.
    (b): E_2 and E_3 are independent.
    (c): E_1 and E_3 are independent.
    (d): E_3 and E_1 are independent.
    (e): E_1, E_2 and E_3 are independent.