

This problem set covers material from Week 6, dates 10/21 – 10/24.

**Instructions:** Write or type complete solutions to the following problems and submit answers to the corresponding Canvas assignment. Your solutions should be neatly-written, show all work and computations, include figures or graphs where appropriate, and include some written explanation of your method or process (enough that I can understand your reasoning without having to guess or make assumptions). A general rubric for homework problems appears on the final page of this assignment.

In some the following, you may need to use R. If you do, please write down the corresponding code to “show your work”. Drawing and labelling curves are also good examples of “showing your work”.

## Monday 10/21

1. In triathlons, it is common for racers to be placed into age and gender groups. Two friends, Leo and Mary, both completed a triathlon. A better performance in the race corresponds to a faster finishing time. Leo competed into the “Men, Ages 30-34” group. Mary competed in the “Women, Ages 25-29” group. Leo completed the race in 4948 seconds, while Mary completed the race in 5513 seconds. Leo did finish faster, but they are curious about how they did within their respective groups. Below is some information on the performance of their groups:
  - “Men, Ages 30-34” group finishing times have a mean of 4313 seconds with a standard deviation of 583 seconds
  - “Women, Ages 25-29” group finishing times have a mean of 5261 seconds with a standard deviation of 807 seconds
  - The distribution of both groups’ finishing times is approximately Normal.
  - (a) Write down the short-hand for the two Normal distributions.
  - (b) What are the  $z$ -scores for Leo and Mary’s finishing times? What is the interpretation of the  $z$ -scores?
  - (c) Did Leo or Mary rank better in their respective group? Explain your reasoning.
  - (d) What percent of the triathletes did Leo finish faster than in his group?
  - (e) What percent of the triathletes did Mary finish faster than in her group?
  - (f) If the distributions of finishing times are not nearly Normal, would your answers to any of (b) - (e) change? Explain your reasoning.
2. Suppose body temperatures are Normally distributed with mean  $98.6^\circ$  F and standard deviation of  $0.7^\circ$  F. Assuming this is true, answer the following:
  - (a) Fevers  $103^\circ$  F or higher are considered dangerous. What fraction of people would be expected to have such high a fever?

- (b) According to a quick Google search, a range for low-grade fever is between  $99.5^{\circ}$  F and  $100.3^{\circ}$  F. What is the probability of having a low-grade fever?
  - (c) What body temperatures would you consider as unusually low? Briefly explain why.
  - (d) Provide two intervals that each capture/contain 80% of body temperatures.
3. Find the standard deviation of the distribution in the following situations.
- (a) MENSA is an organization whose members have IQs in the top 2% of the population. IQs are Normally distributed with mean 100. The minimum IQ scores required for admission to MENSA is 132.
  - (b) Cholesterol levels for women ages 20-34 follow an approximately normal distribution with mean 185 milligrams per deciliter (mg/dl). Women with cholesterol levels above 220 mg/dl are considered to have high cholesterol and about 18.5% of women fall into this category.

**Wednesday 10/23**

TBD

**Thursday 10/24**

TBD

**General rubric**

Points	Criteria
5	The solution is correct <i>and</i> well-written. The author leaves no doubt as to why the solution is valid.
4.5	The solution is well-written, and is correct except for some minor arithmetic or calculation mistake.
4	The solution is technically correct, but author has omitted some key justification for why the solution is valid. Alternatively, the solution is well-written, but is missing a small, but essential component.
3	The solution is well-written, but either overlooks a significant component of the problem or makes a significant mistake. Alternatively, in a multi-part problem, a majority of the solutions are correct and well-written, but one part is missing or is significantly incorrect.
2	The solution is either correct but not adequately written, or it is adequately written but overlooks a significant component of the problem or makes a significant mistake.
1	The solution is rudimentary, but contains some relevant ideas. Alternatively, the solution briefly indicates the correct answer, but provides no further justification.
0	Either the solution is missing entirely, or the author makes no non-trivial progress toward a solution (i.e. just writes the statement of the problem and/or restates given information).
Notes:	For problems with multiple parts, the score represents a holistic review of the entire problem. Additionally, half-points may be used if the solution falls between two point values above.
Notes:	For problems with code, well-written means only having lines of code that are necessary to solving the problem, as well as presenting the solution for the reader to easily see. It might also be worth adding comments to your code.