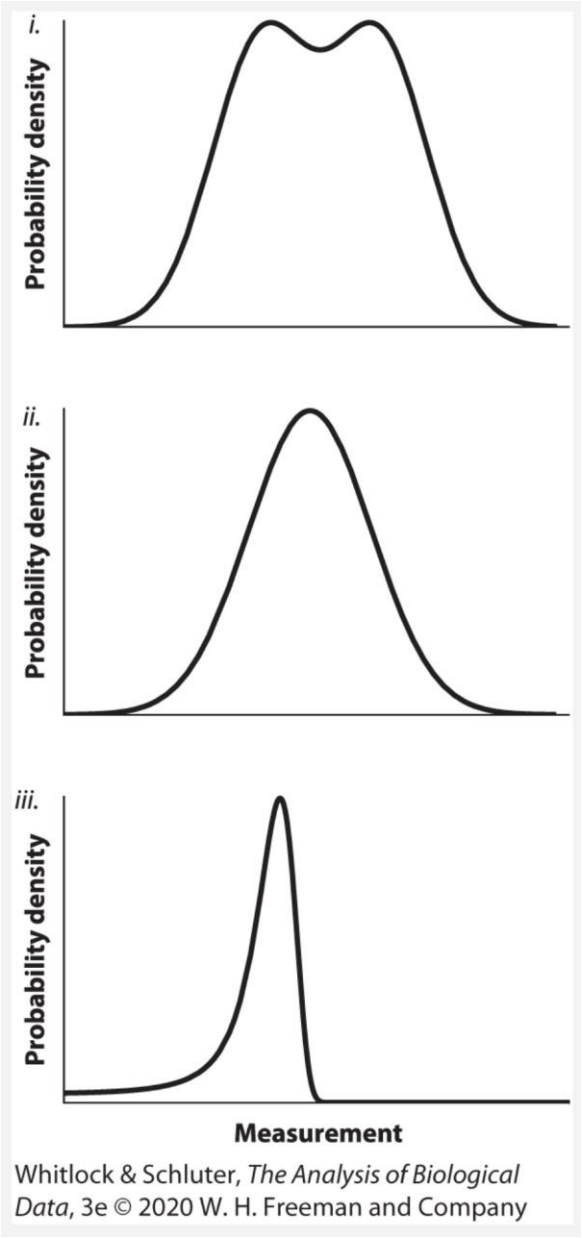
New York University Tandon School of Engineering

Biomedical Engineering
Applied Mathematics and Statistics for Biomedical Engineering

Fall 2021
Professor Mirella Altoe
Tuesday 5:00-7:30PM Rogers Hall 325

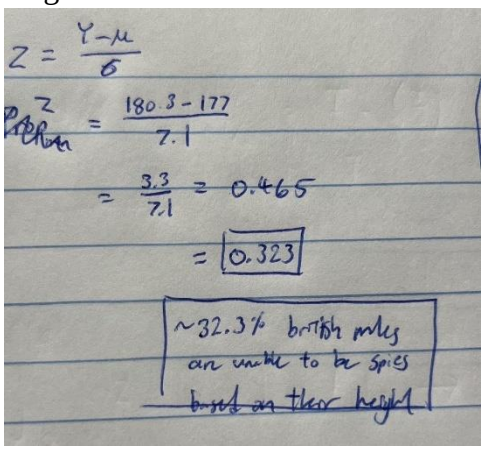
Computer Lab Assignment #6

QUESTION 1: It was rumored that Britain's domestic intelligence service MI5 has an upper limit on the height of its spies, on the assumption that tall people stand out (although MI5 denies it). The rumor said that, to apply to be a spy, you can be no taller than 5 feet 11 inches (180.3 cm) if you are a man, and no taller than 5 feet 8 inches (172.7 cm) if you are a woman (supposedly to allow the spies to blend in with a crowd).



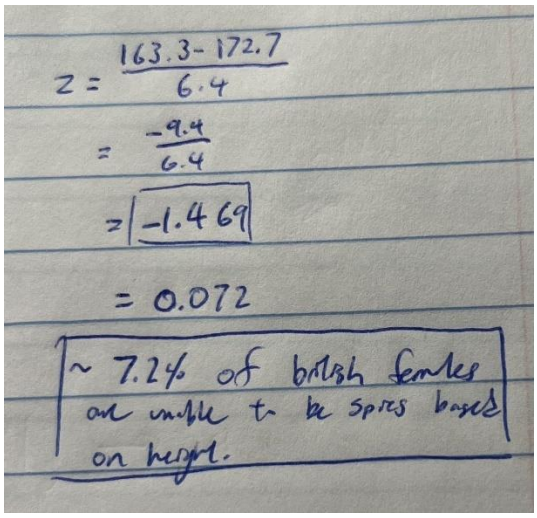
Whitlock & Schluter, *The Analysis of Biological Data*, 3e © 2020 W. H. Freeman and Company

A. **(0.50 pts.)** If the mean height of British men is 177.0 cm, with standard deviation 7.1 cm, what proportion of British men would be precluded from being spies by this hypothetical height restriction? Assume that height follows a normal distribution.



B. **(0.50 pts.)** The mean height of women in Britain is 163.3 cm, with standard deviation

6.4 cm. Assuming a normal distribution of female height, what fraction of women meet the height standard for application to MI5?



QUESTION 2: Use the three distributions labeled i, ii, and iii to answer the following questions.

A. (0.25 pts.) Which of these distributions is most like the normal distribution? On what basis would you exclude the other two?

ii is the most like a normal distribution, i and iii are not normally distributed. A normal distribution resembles a bell curve, where values are clustered around the mean and taper off symmetrically. The further a value is from the mean, the lower its probability density. The probability density is highest at the mean. Probability density in i is highest at two different values, while iii is skewed to the left.

B. (0.25 pts.) Which distributions would generate an approximately normal distribution of sample means, calculated from large random samples? Why?

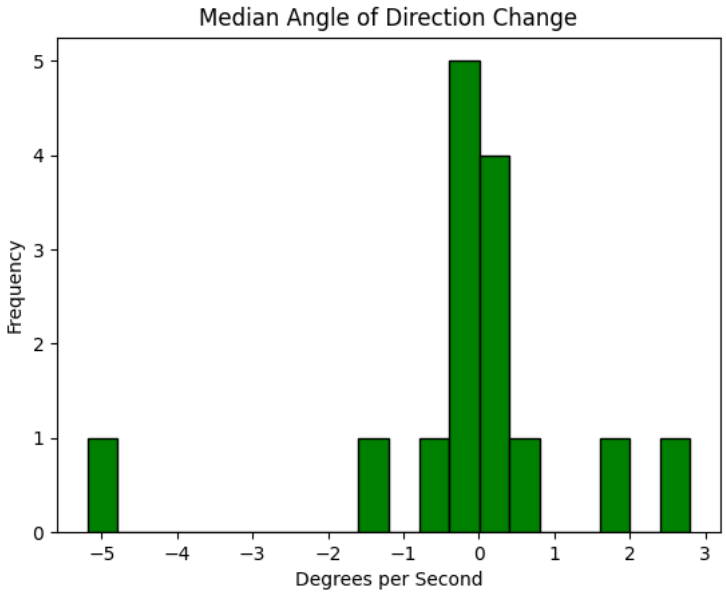
ii would be the normal distribution calculated from a large random sample because most values in the population should roughly be centered around the mean. Smaller samples have a higher probability of including an unusual sample.

QUESTION 3: Without external cues such as the sun, people attempting to walk in a straight line tend to walk in circles. One idea is that most individuals have a tendency to turn in one direction because of internal physiological asymmetries, or because of differences between legs in length or strength. Souman et al. (2009) tested for a directional tendency by blindfolding 15 participants in a large field and asking them to walk in a straight line. (The route of one representative participant is traced in the accompanying figure.) The numbers below are the median change in direction (turning angle) of each of the 15 participants measured in degrees per second. A negative angle refers to a left turn, whereas a positive number indicates a right turn.

Will & Deni McIntyre/Getty Images

$-5.19, -1.20, -0.50, -0.33, -0.15, -0.15, -0.15, -0.07, 0.02, 0.02, 0.28, 0.37, 0.45, 1.76, 2.80$

A. (0.50 pts.) Draw a graph showing the frequency distribution of the data. Is a trend in the mean angle suggested?



The median angle distribution resembles a bell curve.

B. (0.50 pts.) Do people tend to turn in one direction (e.g., left) more on average than the other direction (e.g., right)? Test whether the mean angle differs from zero.

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Mean: -0.13600000000000004
Standard Deviation: 1.6879014866310855
Sample Size: 15
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(<- I did this step in Python)

$$t = \frac{\bar{y} - \mu_0}{s/\sqrt{n}}$$

$$= \frac{-0.136 - 0}{1.688/\sqrt{15}} = \frac{-0.136}{0.436} = -0.312$$

critical value = 2.145

C. (0.50 pts.) Based on your results in part (b), is the following statement justified? "People do not have a tendency to turn more in one direction, on average, than the other direction." Explain.

★ our t value does not exceed the critical value.

Thus, we fail to reject H_0, people do not have a tendency to turn in one direction. (yes, statement justified)