1. (4 pts) Given 2 random variables X and Y

   (a) What is the mathematical definition of covariance, Cov(X,Y)?

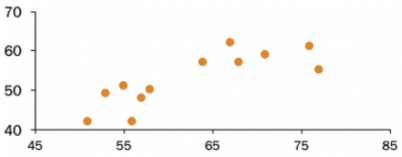
   (b) What is the mathematical definition of correlation, Corr(X,Y)?

2. (2 pts) True or False:
   If Cov(X,Y) = 0 then X and Y are independent random variables.

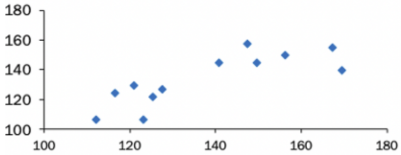
   ◯ True
   ◯ False

3. (4 pts)

   Below is a scatterplot of random variables X and Y:



   Below is a scatterplot of random variables W and Z:



   Which of the following statements are true given the scatterplots above? Select ALL that apply.

   ☐ Cov(X,Y) > 0 ☐ Cov(X,Y) = Cov(W,Z) ☐ Cov(X,Y)<Cov(W,Z)
   ☐ Corr(W,Z)< 0 ☐ Corr(X,Y) = Corr(W,Z) ☐ Corr(X,Y) < Corr(W,Z)

4. (1 pt) You read a news headline that states that eating chocolate is positively correlated with a lower risk of heart disease.
   True or False: From this information you can conclude that eating chocolate causes a lower risk of heart disease.

   ◯ True
   ◯ False

5. (9 pts) The city of Boulder wants to hear from its homeowners on issues related to zoning laws. (For the purposes of this question, homeowners are individuals who own their home, instead of leasing or renting from someone else). One method of surveying would be to have city workers come to CU Boulder's campus and ask passing by students and faculty members for their thoughts. Suppose for now that the question "Are you a homeowner?" is not asked.

   (a) What type of sample is this? (Choose one)
   ◯ Probability Sample ◯ Simple Random Sample ◯ Convenience Sample
   ◯ Systematic Sample ◯ Stratified Random Sample ◯ Random Sample with Replacement

   (b) What forms of error/bias are present in the sampling technique described above? (Select ALL that APPLY)
   ☐ Response Bias ☐ Non-response bias ☐ Chance Error ☐ Selection Bias

   (c) The City of Boulder has a list of all the homeowners' email addresses. Instead of the previous surveying technique, now suppose they take the list of all homeowners' email addresses, shuffle it, and send a survey to every other email address. That is, from the shuffled list, they email the first, third, fifth, seventh, and so on. (You may assume that the shuffling is done uniformly at random, meaning that each email address has the same probability of landing in any particular position. You may also assume that the City of Boulder has the email address for every single homeowner, and that every single homeowner has a unique email address).
   What type of sample is this? (Choose one)
   ◯ Simple Random Sample ◯ Convenience Sample ◯ Probability Sample ◯ Stratified Sample

   (d) Fill in the blank: In this new sampling technique, the sampling frame is _____ the population of interest.
   ◯ Smaller Than ◯ Equal To ◯ Greater Than

   (e) In this new sampling technique, some homeowners may see the survey and choose not to respond.
   True or False: The only form of bias or error in this new surveying technique is non-response bias.

   ◯ True
   ◯ False