**Multiple Choice [15 pts] -- choose the ONE BEST answer for each question by writing the corresponding letter in the blank to the left of the question.**

**\_\_ D \_\_**

**\_\_ D \_\_**

**\_\_ D \_\_**

**\_\_ A \_\_**

**\_\_ C \_\_**

**\_\_ E \_\_**

**\_\_ E \_\_**

**\_\_ D \_\_**

**\_\_ D \_\_**

**\_\_ C \_\_**

**\_\_ C \_\_**

**\_\_ B \_\_**

**\_\_ B \_\_**

**\_\_ C \_\_**

**\_\_ D \_\_**

1. What is the name of the variable that we are interested in predicting or explaining?

A. Continuous B. Discrete C. Explanatory D. Response E. Sampling

1. Which term is defined as “the change in value of the response variable for a unit change in the explanatory variable?”

A. Correlation B. Y-Intercept C. RSS D. Slope E. r2

1. What is the vertical difference between an observed and predicted value of the response variable?

A. Explanatory B. Frequency C. Predicted D. Residual E. Response

1. Which of the following is NOT a possible value for the coefficient of determination?

A. -0.6 B. 0.34789 C. 0.1 D. 0 E. 1

1. What is it when you are asked to make a prediction outside the domain of the explanatory variable?

A. Residual B. Response C. Extrapolation D. Homoscedastic E. Heteroscedastic

1. Which word best describes the situation where the best-fit line goes through the middle of the points on a scatterplot but the points are unequally scattered (i.e., look like a funnel) around that line?

A. Linear B. Non-linear C. RSS D. Homoscedastic E. Heteroscedastic

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1. Which of the following statistics is biased?

A. x B. s C. IQR D. All are biased E. None is biased

1. What is the measure of dispersion among statistics from all possible samples?

A. Response B. Mean C. Replicates D. Standard Error E. Standard Deviation

1. What is the measure of sampling variability?

A. Response B. Mean C. Replicates D. Standard Error E. Standard Deviation

1. Which descriptors best describe the situation where multiple samples produce very similar results but those results do not average out to the true value of the parameter?

A. Accurate, Precise B. Accurate, Imprecise C. Inaccurate, Precise D. Inaccurate, Imprecise

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1. Which term is defined as “the probability of the observed statistic or a value more extreme assuming that the null hypothesis is true?”

A.  B.  C. p-value D. power E. r2

1. What decision should be made if the p-value < ?

**A.** DNR Ho **B.** Reject Ho **C.** DNR HA **D.** Reject HA **E.** None of these

1. Which is the probability of not rejecting a false Ho?

A.  B.  C. p-value D. power E. r2

1. What level of confidence should be used if =0.1 and HA: >o?

A. 0.10 B. 0.50 C. 0.90 D. 0.95 E. 0.99

1. What type of confidence region is constructed if =0.1 and HA: >o?

A. Interval B. Point estimate C. Upper bound D. Lower bound E. Rejection region

**Answer the following questions in the space provided. Show your work where appropriate.**

1. **[9 pts]** Vasey *et al.* (2012; J Anxiety Disord) examined subjects that had a self-described fear of spiders. Each subject
2. In terms of the variables of this problem, interpret the value of the slope?

**As the subjects distress level increases by 1 unit, the spider size discrepancy increases by 0.0036 units, on average.**

1. What is the predicted spider size discrepancy if the subject’s distress level is 80?

0.0036\*80+0.778= **1.066**

1. What is the residual if the subject’s distress level is 30 and the spider size discrepancy is 0.7?

0.7-(0.0036\*30+0.778)= **-0.186**

1. How much would one expect a subject’s spider size discrepancy to change if they could reduce their distress level by 20 points?

20\*0.0036= **0.072**

1. What percentage of the variability in spider size discrepancy is explained by the subject’s distress level?

**12.6%**

1. **[8 pts]** Researchers observed groups of dolphins off the coast of Iceland in 1998. The researchers recorded the time
2. What percentage of all dolphin groups were observed in the evening?

79/189= **41.8%**

1. What percentage of the dolphin groups that were observed in the evening were feeding?

56/79= **70.9%**

1. What percentage of the dolphin groups that were socializing were observed in the morning?

38/62= **61.3%**

1. What percentage of the dolphin groups that were observed in the morning were feeding?

28/72= **38.9%**

1. **[6 pts]** Assume that a wholesale distributor of fertilizer products knows that the weekly demand for 5-Nitrogen, 5-Phosphorous, 6-Potassium fertilizer is slightly right-skewed with a mean of 12 tons and a standard deviation of 3.6 tons. Use this information to answer the questions below.
2. What is the probability that the demand for one week will exceed 14 tons?

**Can’t answer because the population distribution is not known to be normally distributed.**

1. What is the probability that the mean demand for a sample of 20 weeks will exceed 14 tons?

**0.0065** …. distrib(14,mean=12,sd=3.6/sqrt(20),lower.tail=FALSE)

1. What is the probability that the mean demand for a sample of 40 weeks will be between 11.5 and 13 tons?

0.9605-0.1899 = **0.7706** … distrib(13,mean=12,sd=3.6/sqrt(40)) and distrib(11.5,mean=12,sd=3.6/sqrt(40))

1. **[5 pts]** Government researchers examined the relationship between the median price of a house and the percent of the population that was of a “lower status” (as defined by household income, percent unemployed, etc.) for a large sample of communities across the United States. Their results are show in Figure 3. Also note that r = -0.587. In the space below, construct an appropriate bivariate EDA for this information.

Association … **Negative**

Form … **Nonlinear**

Strength … **Moderate**

Outliers … **None**

Use of r … **don’t use it because nonlinear**

1. **[12 pts]** The golden rectangle is a rectangle with a width-to-length ratio of 0.618 (i.e., if the width is divided by the
   1. What are the null and alternative hypotheses?

**Ho: mu=0.618; Ha: mu≠0.618**

* 1. Compute the p-value.

**P= 0.0573** … 2\*distrib(0.6605,mean=0.618,sd=0.1/sqrt(20),lower.tail=FALSE)

* 1. What can you conclude about the beadwork of the Shoshoni and the golden rectangle?

P<a … reject Ho … **the beadwork does not follow the golden rectangle ratio**

* 1. Construct an appropriate confidence region.

0.6605+/-1.645\*0.1/sqrt(20) … **(0.624,0.697)**

* 1. Interpret your confidence region.

**I am 90% confident that the mean ratio of ALL Shoshoni rectangles is between 0.625 and 0.697.**

* 1. Define what a Type I and a Type II error would be in this study.

**Type I – The rectangles follow the golden rectangle, but we conclude that they do not**

**Type II – The rectangles do not follow the golden rectangle, but we conclude that they do.**

1. **[3 pts]** Completely describe all differences between a population and a sampling distribution.

**Popn … all individuals in popn, sd (natural variability), shape usually not known**

**Smplng … all stats, se (sampling variability), shape from CLT**

1. **[3 pts]** Describe choices that you, as a researcher, can make to reduce the margin-of-error. Which is the best choice to make and why?

**Increase n … best because the only cost is monetary**

**Increase a … worse because you allow for more Type I errors**

1. **[3 pts XC]** Biologists often visually estimate the number of geese in a flock to determine relative abundance. Some

N=(Z\*sigma/me)2 = (1.645\*40/5)2 = 173.2 **… 174 researchers**

1. **[4 pts XC]** Compute power if HA: >50, =15, n=25, =0.10, and the actual  is 52.

Crit stat = 53.845 …. crit <- distrib(0.1,mean=50,sd=15/sqrt(25),lower.tail=FALSE,type="q")

Power = **0.2693** … distrib(crit,mean=52,sd=15/sqrt(25),lower.tail=FALSE)