Review problems
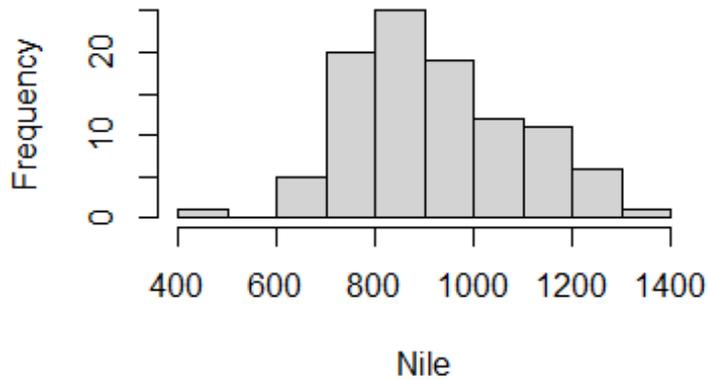
Modules 1-6
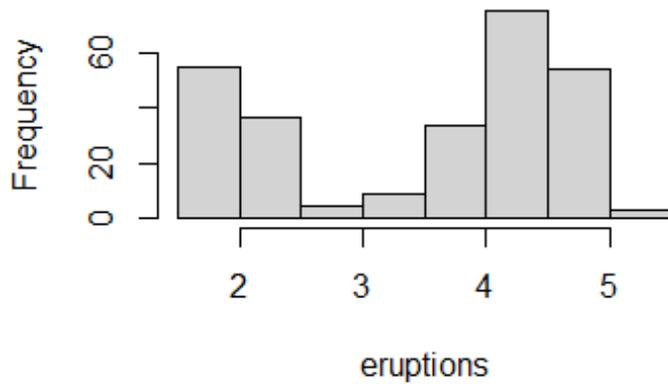
Stat 2510

(1) Describe the distributions of the following histograms (include shape (symmetric, etc.) and modality (unimodal, bimodal, etc.):

    (a) Nile River flow

    (b) Old Faithful eruption duration
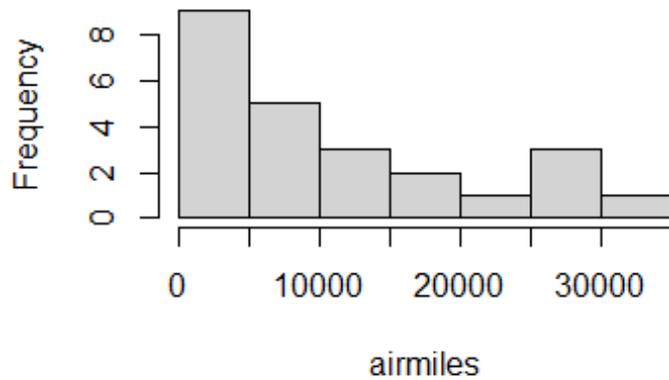
    (c) Passenger air miles flown

    (d) CO_2 levels

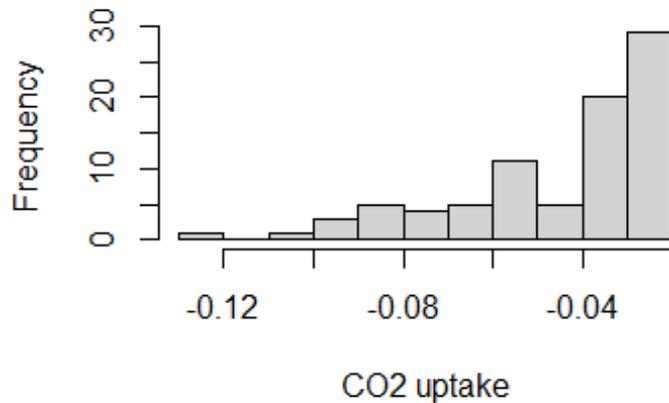**Histogram of Nile**

Histogram of eruptions

Histogram of airmiles

CO2

(2) Use the Empirical Rule to describe the distribution of the Nile River flows. The mean flow of the Nile is 919.35 and standard deviation is 169.23 (in $10^8 m^3$).

(3) Suppose we have the following 7 Ozone measurements from New York, NY (1973). The units of measurement is in ppb (parts per billion).
ozone={41,36,12,18,28,23,19}. Calculate the following:

   (a) Mean
   (b) Variance
   (c) Standard deviation
   (d) Looking at the boxplot, determine if there are any outliers.

Ozone Readings NYC, NY 1973
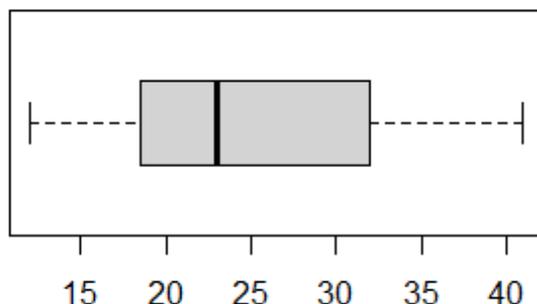
(4) A city council has requested a household survey be conducted in a suburban area of their city. The area is broken into many distinct and unique neighborhoods, some including large homes, some with only apartments, and others a diverse mixture of housing structures. Identify the sampling methods described below, and comment on whether or not you think they would be effective in this setting.

    (a) Randomly sample 50 households from the city.

    (b) Divide the city into neighborhoods, and randomly sample 20 households from each neighborhood.

    (c) Divide the city into neighborhoods, randomly sample 10 neighborhoods, and sample all households from those neighborhoods.

    (d) Divide the city into neighborhoods, randomly sample 10 neighborhoods, and then randomly sample 20 households from those neighborhoods.

    (e) Sample the 200 households closest to the city council offces.

(5) A study is designed to test the effect of light level on exam performance of students. The researcher believes that light levels might have different effects on males and females, so wants to make sure both are equally represented in each treatment. The treatments are fluorescent overhead lighting, yellow overhead lighting, no overhead lighting (only desk lamps).

    (a) What is the response variable?

    (b) What is the explanatory variable? What are its levels?

    (c) What is the blocking variable? What are its levels?

(6) You would like to conduct an experiment in class to see if your classmates prefer the taste of regular Coke or Diet Coke. Briefly outline a design for this study.

(7) Real estate ads suggest that 64% of homes for sale have garages, 21% have swimming pools, and 17% have both. Find the following probabilities:

(a) No garage

(b) No pool

(c) Pool or garage

(d) Pool but no garage

(e) Neither a pool nor a garage

(f) Are having a pool and a garage independent? Show work

(g) Are having a pool and a garage mutually exclusive (disjoint)? Explain

(8) A metal fabricating plant currently has five major pieces under contract, each with a deadline for completion. Let X be the number of pieces completed by their deadlines. Using the following pmf (probability mass function - the table given) to find:

(a) What is the probability of 5 pieces completed by deadline?

(b) What is the probability that at least 3 are completed by deadline?

(c) What is the probability that no more than 3 are completed by deadline?

(d) Calculate $EX, VX,$ and SDX

X	0	1	2	3	4	5
$p(x)$	0.05	0.10	0.15	0.25	0.35	

(10)　　　Dr. Peter Venkman wanted to do a test on ESP. He randomly selected his volunteers and they were shown one card of 4 different ones, one card at a time (blank side facing the subject) and were told to guess what shape they thought was on the back side of the card. The test was done for a total of 10 cards per subject.
(a) What is the name of the probability distribution for this? What are the parameter(s) of this distribution?
(b) What is the probability that a random subject can get exactly one card correct?
(c) What is the probability that they will get at least 8 cards correct?
(d) Suppose that a subject actually has some ESP. Change the probability of success p to 0.5. Now calculate the probability of getting exactly 6 cards correct.
(e) Calculate $EX, VX,$ and SDX, using the probability of success of 0.25

(11)　　　Suppose a small convenience store that, based on historical data, receives an average of 30 customers per hourSuppose that calls come into a call center at a rate of 3 calls per minute. (a) Find the probability that no calls come in the next hour
(b) What is the probability that at least 1 call is received in the next 1 minute?
(c) Calculate $EX, VX,$ and SDX

(12)　　　Find the probability of the following z-scores:
(a) $P(Z < 1.89)$
(b) $P(Z > -0.5)$
(c) Find the z-score that represents the top 9%
(d) $P(-1 < Z < 0.87)$
(e) $P(Z < -7.17)$

(10)   Suppose the diameter at breast height (in.) of maple trees is normally distributed with mean 8.8 and standard deviation 2.8.
(a) What is the probability that the diameter of a randomly selected tree will be at least 10 in.?
(b) What is the probability that the diameter of a randomly selected tree will exceed 20 in.?
(c) What is the probability that the diameter of a randomly selected tree will be between 5 and 10 in.?
(d) What is the probability that the diameter of a randomly selected tree will be less than 6 in.?
(e) How wide are the widest 2% of trees?

(11)   Ithaca, NY is located in upstate New York and averages around 37" of rain each year, with standard deviation of 3.25". Rainfall in Ithaca, NY tends to follow an approximately normal distribution. Say that a student attends Conrnell University in Ithaca and is there for 4 years.
(a) Define the Central Limit Theorem.
(b) Describe the sampling distribution of the sample mean of rainfall in Ithaca, NY. Include the mean of the sampling distribution of the sample mean and the standard deviation of the sampling distribution of the sample mean (standard error).
(c) What is the probability that during the 4 years, we see an average less than 32"?
(d) What are the wettest 3% of years?

(12)   Ithaca, NY is located in upstate New York and averages around 37" of rain each year, with standard deviation of 3.25". Rainfall in Ithaca, NY tends to follow an approximately normal distribution. Say that a student attends Conrnell University in Ithaca and is there for 7 years (undergraduate and graduate degrees).
(a) Describe the sampling distribution of the total rainfall in Ithaca, NY. Include the total of the sampling distribution and the standard deviation of the sampling distribution of the total (standard error)
(b) What is the probability that during the 7 years, we see a total precipitation of less than 220"?
(c) What is the 92nd percentile for total precipitation?

(13)   A survey of purchasing agents from 250 randomly selected industrial companies found that 25% of the buyers reported higher levels of new orders in January than in earlier months.
(a) Describe the sampling distribution of the proportion of buyers in the US with higher levels of new orders in January. Include the mean of the sampling distribution and the standard deviation of the sampling distribution (standard error).
(b) What is the probability that the sample proportion of new orders in January is more than 26%?
(c) What is the probability that the sample proportion of new orders in January is less than 20%?