Mathematics 110   **Fall 2019**

Instructions: Answer all questions. Show all work in the exam booklet.

1. The members of the math department decide to match outfits. The designated color of the matching outfits and the preferences of the math department members are listed below.

Color	Group of 4	Group of 3	Group of 2	Group of 6	Group of 4	Group of 5
White	1√	1√	2√	2	4	3
Red	2√	4	1√	1√	3	4
Yellow	3√	2√	3√	4	1√	2√
Turquoise	4√	3	4	3	2√	1√

   a) Which color would be selected using the plurality method?
   b) Which color would be selected using Borda's method?
   c) Which color would win the approval vote?
   d) Which color is the Condorcet winner, if any?

2. In memory of the retired Space Shuttle Program, the NASA Space Center in Houston decides to apportion 50 displays for the different types of shuttles based on the number of missions of each shuttle.

Shuttle	Columbia	Challenger	Discovery	Atlantis	Endeavour
Number of Missions	27	10	39	33	25

   a) What is the natural divisor?
   b) What are the natural quotas?
   c) Apportion the 50 displays using Lowndes' method.
   d) Apportion the 50 displays using Jefferson's method.
   e) How would a state quota of 6.4471 be apportioned according to the Hill-Huntington method?

3. Suppose that there are 130 votes cast in an election among four candidates- Tony, Steve, Natasha, and Bruce -to be decided by plurality. After the first 100 votes are counted the tallies are as follows:

Tony	18
Steve	27
Natasha	12
Bruce	43

   If there are 30 votes left,

   a) What is the minimal number of votes Bruce needs to be assured of a win?
   b) What is the minimal number of votes Steve needs to be assured of a win?

4. Suppose a survey indicated that the average number of hours spent weekly by faculty at a university doing work is $\mu = 60$ with standard deviation $\sigma = 9$. Assume that the distribution is normal.
    a) Sketch a normal curve indicating values for at least ± 2 standard deviations
    b) Find the percentage of faculty who spend below 50 hours.
    c) Find the percentage of faculty who spend between 63 and 71 hours.
    d) Below what number of hours does 85.77% of faculty spend?
    e) Assuming $n = 36$, what is the probability a random sample will yield an average weekly number of hours ($\bar{x}$) below 50 hours?
    f) Assuming $n = 36$, with what probability can we assert a sample average ($\bar{x}$) will fall within 5 hours of $\mu = 60$?

5. A random sample of 20 grades on a calculus exam is listed below:

36	55	57	59	61	63	64	67	70	73
76	76	79	83	86	93	94	95	96	97

    a) What proportion of the grades are above an 85?
    b) Calculate the mean, median, mode, and range of the sample.
    c) Find the sample standard deviation.
    d) Find the quartiles.
    e) Construct and label a box-and-whisker plot.

6. A woman's wardrobe consists of 3 blouses (white, gray, and yellow), 4 scarfs (white, blue, green, and purple), and 2 skirts (white and black).
    a) How many different outfits are possible if she wears a blouse, scarf, and skirt?
    b) What is the probability of her wearing a white blouse and a black skirt?
    c) What is the probability of her wearing a white blouse, white scarf, and white skirt?
    d) If she wears a blouse, scarf, and skirt, what is the probability of her not wearing all white?

7. An experiment has outcomes 4, 5, 6, 7, and 8 with probabilities as shown.

p(x)	.16	.24	.26	.12	?
x	4	5	6	7	8

    a) Find the missing $p(x)$.
    b) Calculate the mean and the standard deviation.
    c) Construct the probability histogram.

8. A baker has 9 different flavored cupcakes and would like to choose 3 to be on display.
    a) How many displays of three different flavored cupcakes is possible?
    b) If one cupcake is to be displayed in front, another cupcake in the middle, and the third cupcake in the back, how many different displays are possible?