QUEENS COLLEGE
DEPARTMENT OF MATHEMATICS

Final Examination

Mathematics 110 **2 ½ Hours** **Spring 2015**

Instructions: Answer all questions. Show all work.

1. In a city with five towns, each town's population is listed below:

Town	Alexandria	Bohemia	Carthage	Denville	Exeter
Population	23,703	12,562	15,904	18,752	19,828

The city is planning to build 110 new schools and would like to apportion them to the towns based on their populations.

(a) Apportion the new schools using Hamilton's Method.
(b) Apportion the new schools using Lowndes' Method.
(c) Apportion the new schools using Jefferson's Method.

2. A senior high school class is voting on which cuisine to have for their senior class prom. The students' preference rankings for the different cuisines are listed below:

Cuisine	**19**	**22**	**17**	**12**	**24**	**11**
Italian	3 ☑	1 ☑	3	5	2 ☑	5
American	4	4	4	4	1 ☑	2 ☑
French	1 ☑	3	5	2 ☑	4	3 ☑
Chinese	2 ☑	2 ☑	2 ☑	1 ☑	3	4
Greek	5	5	1 ☑	3 ☑	5	1 ☑

(a) Which cuisine would be selected using the plurality method?
(b) Which cuisine would be selected using the plurality method with a runoff between the top two cuisines?
(c) Which cuisine would be selected using Borda's method?
(d) Which cuisine would be selected using the approval voting method?

3. A special die has faces marked 2-3-3-7-8-9. If the die is rolled twice, find the probability that
(a) the first roll is equal to the second roll.
(b) the sum of the two rolls is greater than 10.
(c) only one roll comes up even.

4. (a) Abigail, Benjamin, Clara, Daniel, Elizabeth, and Frank are running for Treasurer of their senior class. After the first 126 votes are counted, Abigail receives 33 votes, Benjamin receives 23 votes, Clara receives 19 votes, Daniel receives 11 votes, Elizabeth receives 24 votes, and Frank receives 16 votes. If there are 73 votes left, what is the minimal number of the remaining votes Clara needs to be assured of a win?

(b) An election among six candidates is to be determined by plurality. If 524 votes are cast, what is the smallest number of votes a winning candidate can have?

(continued on the back)

5. The heights of students for a senior class have an approximately normal distribution with a mean of 67 inches and a standard deviation of 3.1 inches.
   (a) Find the percentage of heights between 63 inches and 67 inches.
   (b) Find the percentage of heights between 60 inches and 70 inches.
   (c) Above what height is the tallest 19.77% of the class?
   (d) If there are 1700 students in the senior class, how many students are taller than 72 inches?

6. Consider an experiment with outcomes 0, 2, 3, 4, 6, whose probabilities are listed below:

p(x):	.14	.21	.3	?	.1
x:	0	2	3	4	6

   (a) Find the missing *p(x)* value.
   (b) Calculate the mean and standard deviation.
   (c) Construct the probability histogram. Carefully label the axes.

7. A random sample of ages for people attending a local concert are listed below:

25	34	52	27	40	44	67	35	19	44	36	55
39	58	16	37	61	30	21	63	49	47	31	22

   (a) Identify the median and the first and third quartiles.
   (b) Identify the mode and calculate the range for this sample.
   (c) Find the sample mean and sample standard deviation.
   (d) Construct a histogram with the first class interval for 10 – 19.

8. A large pharmaceutical company is conducting millions of trials for a new experimental drug. It is known that 17% of people taking this experimental drug will experience side effects. Find the probability that in a random selection of 1387 people taking this drug
   (a) at least 230 will experience side effects.
   (b) exactly 250 will experience side effects.
   (c) the number of people who experience side effects is between 240 and 252.