

**Queens College
Department of Mathematics**

**Final Examination
2.5 Hours**

Mathematics 110

Fall 2015

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

1. A random sample of grades on a physics exam is listed below.

75 58 59 78 77 77 75 89 86 71 95 80
70 65 77 83 82 68 98 72 88 91 66 84

- (a) Construct a histogram with the first class interval 50-59 and identify the modal class.
- (b) What is the range of this data?
- (c) Identify the five number summary of this data.
- (d) Find the mean and standard deviation.

2. (a) Five candidates – Ariel, Belle, Elsa, Mulan, and Tiana – are running for president of the Gisnep organization. After the first 76 votes are counted, the tallies are as follows:

Ariel 16
Belle 14
Elsa 11
Mulan 20
Tiana 15

If 24 votes remain, what is the minimal number of remaining votes Ariel can receive and be assured of a win?

(b) If 964 votes are cast in an election, what is the smallest number of votes a winning candidate can have in a six-candidate race to be decided by plurality?

3. In a county with four school districts, the student population of each school district is listed below. There are 25 new teaching positions to be allocated to the districts based on student population.

School District	North	East	South	West
Student Population	1300	2400	1800	1500

- (a) Apportion the new teaching positions using Hamilton’s Method.
- (b) Apportion the new teaching positions using Lowndes’ Method.
- (c) Apportion the new teaching positions using Hill-Huntington’s Method.

4. The 47 members of the English department at school are voting on which American poet to do a unit on next year. Their preference rankings are listed below (approval is indicated with √):

Poet	<i>Number of Voters</i>					
	10	5	1	11	11	9
Robert Frost	1 √	3	2 √	2	5	4
Maya Angelou	2 √	4	1 √	1 √	4	5
Edgar Allen Poe	3	5	5	3	1 √	2 √
Langston Hughes	4	1 √	3 √	5	2 √	3
Sylvia Plath	5	2 √	4	4	3	1 √

- (a) Which poet would be selected using the plurality method?
- (b) Which poet would be selected using the plurality method with a runoff between the top two finishers?
- (c) Which poet would be selected using Borda’s Method?
- (d) Which poet would be selected using an approval vote?

(continued on other side)

5. (a) Suppose an antique vase is insured against theft by paying an annual premium of \$300. If the vase is stolen, the insurance company pays the policy holder \$70,000. The probability of theft is $\frac{1}{400}$ annually. Calculate the expected gain from the point of view of the insurance company.

(b) How many unique 6-digit student ID numbers can be made from the digits 0-9, if the first digit cannot be 0 and repetition of digits is allowed?

6. Scores on an economics exam have an approximately normal distribution with a mean of 74 points and a standard deviation of 6.

(a) Find the percent of scores above 78.

(b) Find the percent of scores below 74.

(c) If 1000 students took the exam, about how many students scored between 68 and 71?

(d) Below what grade can you find 84.13% of all grades?

7. It is known that when Link shoots an arrow at a wooden target using his recurve bow, he'll hit the target 88% of the time. If Link shoots arrows at 150 wooden targets, find the probability that

(a) he'll hit exactly 124 targets.

(b) he'll hit between 132 and 136 targets, inclusive.

(c) he'll hit 139 or more targets.

8. On a special die, the faces are marked 1-3-4-5-A-B. When the die is rolled twice, find the probability that

(a) both rolls land on a letter.

(b) both rolls come up the same.

(c) at least one roll is an even number.