

**QUEENS COLLEGE
DEPARTMENT OF MATHEMATICS**

**Final Examination
2 ½ Hours**

Mathematics 110

Spring 2008

Instructions: Answer all questions. Show all work.

1. Consider the weighted voting system [q : 20,15,10,7,7,1]
 - (a) What is the smallest value that the quota q can be?
 - (b) What is the value of q if 70% of the votes are needed to pass a motion?
 - (c) Find a possible value of q for which P_1 is the only player with veto power.
 - (d) How many Banzhaf coalitions are there?
 - (e) How many sequential coalitions are there?

2. In each of the following weighted voting system, determine which players are dictators, have veto powers, or are dummies.
 - (a) [48:25,22,18,1]
 - (b) [19:21,8,5,2]
 - (c) [30:15,15,15,14]

3. Consider the weighted voting system [19:9,8,5,2]
 - (a) Find the Banzhaf power distribution.
 - (b) Find the Shapley- Shubik power distribution.

4. A population grows according to the logistic growth model with growth parameter of 3.4 and initial population of 0.52.
 - (a) Find P_{21} .
 - (b) What percent of the habitat's carrying capacity is taken up by the 25th generation?
 - (c) What does the logistic growth model predict in the long term for this population?
 - (d) Support this description by sketching an appropriate graph.

5. Two banks are competing to get more customers. Bank A offers $7\frac{2}{5}\%$ annual interest compounded monthly, while Bank B offers 7.42% annual interest compounded quarterly.
 - (a) Find the effective annual yield for each bank.
 - (b) For the bank that has the higher effective annual yield, what would be the value of the account after 7 years if the initial deposit were \$30,000?

(over)

6. The weights (in pounds) of the students in an elementary school are:

80 58 38 81 73 60 50 62 51 70 80 37 63 64 52
67 77 53 74 64 53 66 65 54 69 55 89 64 88 75

- (a) Draw a histogram with the first class interval of 30-39. Carefully label both axes.
- (b) Find the five - number summary.
- (c) Find the mean and standard deviation.
7. The sides of a special die are numbered 1-2-2-3-4-4. If this die is rolled twice, find the probability that
- (a) the sum is equal to 4.
- (b) at least one of the two rolls comes up 2.
- (c) the first roll is odd and second roll is even.
- (d) both rolls are even if their sum is equal to 4.
8. The grades in a Math 110 class at Queens College have an approximately normal distribution with mean of 75 and standard deviation of 5.
- (a) Find the percent of grades below 75.
- (b) Find the percent of grades that are at least 70.
- (c) Find the percent of grades between 80 and 85.
- (d) If there are 150 students in the class, how many failed the course if a grade of 65 is needed to pass.
9. A die is tossed 2592 times. A number greater than 4 comes up 830 times. Should you be suspicious about the honesty of the die with 68% certainty? How about 95% certainty? Explain.
10. (a) Should a new election be ordered if there are 875 votes of which 120 are fraudulent and the winner's plurality is 25?
- (b) How big must a winner's plurality be for a re-election if 1500 votes are cast and 59 are fraudulent?