

**QUEENS COLLEGE
DEPARTMENT OF MATHEMATICS**

**Final Examination
2 ½ Hours**

Mathematics 110

Fall 2006

Instructions: Answer all questions. Show all work.

- 1) In the weighted voting system [q : 32, 19, 14, 8, 5, 1]
 - (a) What is the smallest value that q can be?
 - (b) What is the largest value that q can be?
 - (c) What is the value of q if 68% of the votes are needed to pass a motion?
 - (d) How many Banzhaf coalitions are there?
 - (e) How many sequential coalitions are there?

- 2) In each of the following weighted voting systems, determine which players are dictators, have veto power, or are dummies.
 - (a) [30: 16, 13, 5, 1]
 - (b) [16: 17, 6, 3, 2]

- 3) Consider the weighted voting system [17: 9, 8, 5, 3]
 - (a) Find the Banzhaf power distribution.
 - (b) Find the Shapley-Shubik power distribution.

- 4) For a savings account bank, A offers 4.25% annual interest compounded daily while bank B offers $4\frac{3}{8}\%$ annual interest compounded monthly.
 - (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 5 years if the initial deposit was \$9000?

- 5) A population grows according to the logistic growth model with growth parameter of 2.75 and initial population of .3
 - (a) Find P_{12}
 - (b) What percent of the habitat's capacity is taken up after the 25th transition?
 - (c) Describe the growth of this population. Support this description by sketching an appropriate graph.

- 6) The grades on an exam are:
49, 58, 72, 65, 52, 43, 79, 93, 82, 45, 60, 63, 78, 66, 54
80, 69, 55, 72, 81, 61, 74, 78, 85, 74, 65, 78, 98, 75, 73
 - (a) Find the mean, median, and standard deviation.
 - (b) Find the five-number summary.
 - (c) Draw a histogram with 1st class interval of 40-49. Carefully label both axes.

- 7) Suppose a fair die is rolled twice. Find the probability that
 - (a) both rolls come up the same.
 - (b) the sum is greater than three.
 - (c) at least one of the rolls comes up odd.

(over)

- 8) Scores on an exam have an approximately normal distribution with mean of 72 and standard deviation of 6.
- (a) Find the percent of grades below 72.
 - (b) Find the percent of grades above 66.
 - (c) Find the percent of grades between 84 and 90.
 - (d) If 200 students took the exam, approximately how many scored between 60 and 78?
- 9) A dishonest coin with a probability of heads $p=.2$ is tossed $n=1600$ times. Let the random variable X represent the number of times the coin comes up heads.
- (a) Find the mean and standard deviation for the distribution of X .
 - (b) Which of the following bets would you choose? Explain your answer.
 - (i) The number of heads will fall somewhere between 304 and 336.
 - (ii) The number of heads will be less than or equal to 304 or greater than or equal to 336.
- 10) (a) Should a new election be ordered if there are 1240 votes of which 125 are fraudulent and the winner's plurality is 23? Explain your answer.
- (b) How big must a winner's plurality be for an election to be declared valid if 1,100 votes are cast and 58 are fraudulent?