

**QUEENS COLLEGE  
DEPARTMENT OF MATHEMATICS**

**Final Examination  
2 ½ Hours**

**Mathematics 110**

**Spring 2007**

**Instructions: Answer all questions. Show all work.**

- 1) For a similar account, Royal Bank offers 3.09% annual interest compounded daily while Silver Bank offers  $3\frac{1}{8}\%$  annual interest compounded monthly.
- Compute the effective annual yield for each bank.
  - For the bank that has the higher effective annual yield, what would be the value of the account after 4 years if the initial deposit was \$10,000?
- 2) The ages of the participants of a marathon are
- 63 74 46 39 75 29 76 52 48 34 60 57 68 46 61 23 69 75  
67 54 60 36 67 41 57 73 62 59 63 28 71 30 63 75 56 31
- Find the median and mean.
  - Find the range and standard deviation.
  - Draw a histogram with the 1<sup>st</sup> class interval of 20-29. Carefully label both axes.
- 3) Suppose a fair die is rolled twice. Find the probability that
- the sum is more than 2.
  - the 2<sup>nd</sup> roll is 3 less than the 1<sup>st</sup> roll.
  - at least one of the rolls comes up "7".
  - only one roll comes up even.
- 4) Consider the weighted voting system [q: 30, 21, 16, 14, 9, 5].
- What is the smallest value that q can be?
  - What is the value of q if 67% of the votes are needed to pass a motion?
  - How many (Banzhaf) coalitions are there?
  - How many sequential coalitions are there?
- 5) Consider the weighted voting system [26: 18, 15, 7, 4].
- Find the Banzhaf power distribution.
  - Find the Shapley-Shubik power distribution.
- 6) Scores on an exam have an approximately normal distribution with mean of 65 and standard deviation of 7.
- Find the percent of scores below 65.
  - Find the percent of scores above 58.
  - Find the percent of scores between 44 and 51.
  - If 283 students took the exam, approximately how many scored between 58 and 79?

(over)

- 7) A die is rolled 600 times. An odd number shows up 270 times. With 95% certainty, is this a fair die? Justify your answer.
- 8) A population grows according to the logistic growth model with growth parameter of 3.2 and initial population of .04.
- Find  $P_{15}$ .
  - What percent of the habitat's carrying capacity is taken up after the 24<sup>th</sup> transition?
  - Describe the growth of this population. Support this description by sketching an appropriate graph.
- 9) a) Should a new election be ordered if there are 618 votes of which 140 are fraudulent and the winner's plurality is 22? Explain your answer.
- b) How big must a winner's plurality be for an election to be declared valid if 1070 votes are cast and 83 are fraudulent?