

**QUEENS COLLEGE  
DEPARTMENT OF MATHEMATICS**

**Final Examination**

**2  $\frac{1}{2}$  Hours**

**Mathematics 110**

**Fall 2008**

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

1. Consider an arithmetic sequence with  $a_0 = 5$  and  $d = 7$ 
  - a. Find  $a_{100}$
  - b. Find the sum of the terms from  $a_0$  to  $a_{100}$ .
  
2. Bank M offers 5.6% annual interest compounded monthly, while Bank N offers  $5\frac{5}{8}\%$  annual interest compounded quarterly.
  - a. Compute the effective annual yield for each bank.
  - b. For the bank that has the higher effective annual yield, what would be the value of an account after 5 years that started with \$7,000?
  
3. The grades on a recent exam were as follows:  
83, 75, 68, 74, 92, 99, 54, 82, 87, 96, 74, 77, 86, 69, 89, 92, 84, 97, 79, and 85.
  - a. Find the min, the max,  $Q_1$ , the median,  $Q_3$ , the mean and the standard deviation.
  - b. Draw a histogram with the first class interval 50-59.
  
4. A population grows logistically with  $P_0 = .75$  and  $r = 3.33$ .
  - a. Find  $P_1$ ,  $P_{10}$  and  $P_{20}$ .
  - b. Describe the growth of this population. Support this description by drawing an appropriate graph.
  
5. Six hundred students take the MAT test. Their scores are normally distributed with mean = 28 and standard deviation = 4.
  - a. What % of students received grades over 32?
  - b. What % of students received grades between 20 and 32?
  - c. The passing score is 24. Approximately how many students pass the test?
  
6. A coin is tossed 900 times resulting in 500 heads. With 95% certainty, is this a fair coin?  
**Justify your answer.**
  
7. Two dice are rolled. Find the probability that
  - a. the sum is 3.
  - b. the sum is divisible by 3.
  - c. the spelling of the resulting sum has exactly three letters.
  
8. Consider the weighted voting system [8: 5,3,2,1].
  - a. Determine the Banzhaf power index for each voter.
  - b. Which voters would gain power and which voters would lose power if the quota was changed to 7? **Justify your answer.**
  
9. Consider the weighted voting system [10: 9,4,3,1].
  - a. Determine the Shapley-Shubik power index for each voter.
  - b. Determine all dictators, dummy voters and voters with veto power.
  
10.
  - a. Should a new election be ordered if there are 953 votes, of which 52 are declared fraudulent, and the winner's plurality is 16?
  - b. How big must a winner's plurality be for an election to be declared valid if 2015 votes are cast and 96 are fraudulent?