

**Quiz 3**

**Instructions:** This quiz is worth a total of 20 points with the point value of each question is listed with each question. You may use any notes or books but you must work individually. Make sure to write clearly and justify your answers.

- (1.)(6 pts.) Suppose that a 20-sided die is rolled 8 times. What is the exact probability that:
- (a.) exactly 5 of the rolls were higher than a 7,
  - (b.) at most 4 of the rolls were lower than a 5.
  - (c.) Given that 2 three's were rolled in the first 5 rolls, what is the probability that a total of 4 three's were rolled?
- (2.)(6 pts.) Suppose that a coin is biased so that heads occurs with a probability of 0.53. Using an appropriate approximation to find:
- (a.) the probability that there are between 490 and 510 heads in 1000 flips,
  - (b.) the probability that there are exactly 530 heads in 1000 flips.
  - (c.) What is the minimum number of flips required so that there is a 95% chance that at least half of the flips are heads?
- (3.)(4 pts.) Suppose that a bag contains 5000 coins, 2 are silver, the rest are gold. If 1000 coins are drawn with replacement, use an appropriate approximation to find:
- (a.) the probability that fewer than two silver coins occur,
  - (b.) the probability that exactly two silver coins occur.
- (4.)(4 pts.) Suppose that a box contains 100 balls, 60 are red and 40 are white.
- (a.) If 4 balls are drawn, without replacement, what is the probability that exactly 3 are white?
  - (b.) If 4 balls are drawn, with replacement, what is the probability that exactly 2 are red?