1. a. Consider a Malthusian decaying population model:

$$P_{n+1} = 0.7P_n, \qquad P_0 = 200,$$

where n is in years. Determine the population for each of the years until the population falls below one individual.

b. Now consider a random death only model for a population. Start with a population of 200 individuals. Each individual has a 70% chance of surviving until the next year. Perform a Monte Carlo simulation showing the population at each year until the population goes extinct.

c. Run the simulation in Part b 1000 times and compute the average population at 1 and 3 years for these simulations. Also, compute the standard deviation for these 1000 simulations at 1 and 3 years. Find the average time until extinction and the standard deviation of this time until extinction. Compare these results to your calculations in Part a.

5.3 Project 2. *Darts* Work this problem on p. 191 of the text.

(**Bonus**) Provide an computer program and analysis for either **5.3 Project** 1. *Blackjack* p. 190 or 5. *Roulette* p. 193 from the text.