NYCCT MAT 2572 Halleck Fall 2016 Practice exam 3

The exam will consist of problems similar to the following 5 problems (20% each). You may use your calculator and/or your computer (Excel, Maple, MATLAB, R) as an aid. You are encouraged to bring in a formula sheet and instructions for each problem and even a template for software use. On the exam, I will keep the same numbering to avoid confusion.

1. On-the-job injuries in a textile mill severe enough to lead a worker to ask for disability leave occur at the rate of 0.1 per day. We model using the Poisson distribution.
   1. What 2 assumptions do we make?
   2. What may make these assumptions unrealistic for our situation?
   3. What is the probability that two injuries will occur during the next (six-day) workweek?
   4. The probability that four injuries will occur over the next two workweeks is not the square of your answer to part (a). Explain why not and find it.
2. Recently married, a young couple plans to continue having children until they have their first girl. Our “experiment” is to count the number of boys born until that girl is born. We model using the geometric distribution with p = 1/2.
   1. What 2 assumptions do we make?
   2. What may make these assumptions unrealistic for our situation?
   3. On average, how many boys will be born? What is the couple’s expected family size?
   4. What is the variance for the number of boys? For the family size? Are they different? If not, why not?
3. A machine has a 1% probability of producing a defective item. Each day, the machine is run until a defective item is produced and then it undergoes extensive repair which requires the rest of the day. We count the number of usable items produced in one 5-day workweek and model using negative binomial distribution.
   1. What is the average number of usable items that will be produced?
   2. What is the standard deviation?
   3. What is the probability that a machine will produce 500 or more usable items?
   4. Draw an approximate graph of the distribution, marking off the mode (exact), mean (a.) and median (use excel).
4. The next generation of space shuttle will include three fuel pumps —one active, the other 2 in reserve. If the primary pump malfunctions, a second is automatically brought on line. A mission will require that fuel be pumped for 50 hours. The average lifespan of a pump is 100 hours. We model using the gamma distribution.
   1. If the pumps are allowed to go until all 3 failed, on average how many hours will that be?
   2. What are the chances that the fuel pump system will not remain functioning for the mission?
   3. Find the median for the fuel system’s life.
   4. Draw an approximate graph of the distribution, marking off the mode (exact), mean (a.) and median (use excel). Also, shade the portion of the graph corresponding to b.
5. There are 2 candidates in a high school student government election, 55% of the students favor the incumbent in her bid for re-election. If 200 students vote, approximate the probability that
   1. the race ends in a tie;
   2. the challenger scores an upset victory using the binomial distribution.
   3. the challenger scores an upset victory using the normal distribution w/ continuity correction.
   4. Draw a picture showing the normal distribution (-3<Z<3) and shade the region corresponding to part c. Provide both standard and nonstandard labels.