What distribution to use (Discrete)?

For each of the following situations, determine which distribution is used and why. The numeric answers to each part are on the slides.

1. A town of 100,000 inhabitants is exposed to a contagious disease. If the probability that a person becomes infected is 0.04, what is the expected number of people who become infected? What is the variance of this number?

2. Every week, the average number of wrong phone calls received by a certain mailorder house is seven. What is the value of the parameter(s) of the distribution?

3. A quality assurance engineer of a company that manufactures TV sets inspects finished products in lots of 100. She selects 5 of the 100 TVs at random and inspects them thoroughly. If, in fact, 6 of the 100 TVs in the current lot are actually defective, what is the expected value of the number of TVs that she finds to be defective? What is the variance of this number?

4. Suppose that we roll an 8-sided die until five ‘1’s are rolled. a) What is the probability that it will take 10 tries to roll five ‘1’s? b) What is the expected number of times it will take to roll five ‘1’s? c) What is the variance of this number?

5. Every second, 1.8 cosmic rays hit a specific spot on earth. Assume that we start counting at t = 0 seconds. a) What is the probability that there are exactly 12 cosmic rays hitting the spot between 10 seconds and 15 seconds? b) Given that exactly 3 cosmic rays hit the spot between 4 seconds and 5 seconds, what is the probability that 12 cosmic rays hit the spot between 10 seconds and 15 seconds? c) What is the probability that at least one cosmic ray hits the spot between 4 seconds and 5 seconds and between 10 seconds and 15 seconds?

6. The Lotto. In the Hoosier lotto, a player specifies six numbers of her choice from the numbers 1–48. In the lottery drawing, six winning numbers are chosen at random without replacement from the numbers 1 – 48. To win a prize, a lotto ticket must contain two or more of the winning numbers. a) If the player buys one Lotto ticket, determine the probability that she wins a prize (at least 2 numbers correct). b) If the player buys one Lotto ticket per week for a year, determine the probability that she wins a prize at least once in the 52 tries.

7. A charitable organization is conducting a raffle in which the grand prize is a new car. Five thousand tickets, numbered 0001, 0002…, 5000 are sold at $10 each. At the grand-prize drawing, one ticket stub will be selected at random from the 5000 ticket stubs. What is the probability that a person will win if they hold tickets numbered 1003 – 1025.

8. Between the hours of 2 and 4 pm, the average number of phone calls per minute coming into the switchboard of a company is 2.5. Find the probability that the number of calls during one particular minute will be a) 0, b) 2 or fewer. c) What is the value of the variance of this distribution?

9. On my page of notes, I have 2150 characters. Say that the chance of a typo at any character (after I proof it) is 0.001. a) What is the probability of exactly 1 typo on this page? b) What is the probability of at most 3 typos? c) What is the expected number of typos on a page? d) What is the variance of this number?

10. Suppose that we roll an 12-sided die until a ‘1’ is rolled. a) What is the probability that it will take 6 tries to roll the ‘1’? b) What is the expected number of times it will take to roll a ‘1’? c) What is the variance of this number?
11. A textbook author is preparing an answer key for the answers in a book. In 500 problems, the author has made 25 errors. If a second person checks seven of these calculations randomly, what is the probability that he will detect two errors? Assume that the second person will definitely find the error in an incorrect answer. What are the expected value of the number of errors that he will find? What is the variance of this number?

12. A restaurant serves eight entrées of fish, 12 of beef, and 10 of poultry. If customers select from these entrées randomly, what is the probability that a) two of the next four customers order fish entrées? b) At most one of the next four customers orders fish? c) At least one of the next four customers orders fish?