

2.4. Discrete Probability Distributions

Exercise

1. Ten coins are tossed simultaneously. Find the probability of getting at least seven heads.
2. A multiple choice test consists of 8 questions with 3 answers to each question (of which only one is correct). A student answers each question by rolling a balanced die and checking the first answer if he gets 1 or 2, the second answer if he gets 3 or 4 and the third answer if he gets 5 or 6. To get a distinction, the student must secure at least 75% correct answers. If there is no negative marking, what is the probability that the student secures a distinction?
3. In a precision bombing attack there is a 50% chance that any one bomb will strike the target. Two direct hits are required to destroy the target completely. How many bombs must be dropped to give a 99% chance or better of completely destroying the target?
4. A manufacturer of pins knows that 5% of his product is defective. If he sells pins in boxes of 100 and guarantees that not more than 10 pins will be defective, what is the probability that a box fails to meet the guaranteed quality?
5. An insurance company insures 4,000 people against loss of both eyes in a car accident. Based on previous data, the rates were computed on the assumption that on the average 10 persons in 1,00,000 will have car accident each year that result in this type of injury. What is the probability that more than 3 of the insured will collect on their policy in a given year?

6. A manufacturer, who produces medicine bottles, finds that 0.1% of the bottles are defective. The bottles are packed in boxes containing 500 bottles. A drug manufacturer buys 100 boxes from the product of bottles. Find how many boxes will contain (i) no defective, and (ii) at least two defectives.
7. Six coins are tossed 6,400 times. Using Poisson distribution, find the approximate probability of getting six heads two times.
8. Find the probability that a person tossing 3 coins will get either all heads or all tails, for the second time on the fifth toss.
9. If the probability is 0.4 that a child exposed to a certain contagious disease will catch it, what is the probability that the tenth child exposed to the disease will be third to catch it.
10. If the probabilities of having a male or female child are both 0.5, find the probability that
 - a) a family's fourth child is their first son
 - b) a family's seventh child is their second daughter
 - c) a family's tenth child is their fourth or fifth son

Answers:

1. $\frac{176}{1024}$

2. $\frac{129}{729 \times 9}$

3. 11

4. $1 - e^{-5} \sum_{x=0}^{10} \frac{5^x}{x!}$

5. 0.0008

6. (i) 61 (ii) 9

7. $\frac{e^{-100}(100)^2}{2}$

8. $\binom{4}{1} \left(\frac{1}{4}\right)^2 \left(\frac{3}{4}\right)^3$

9. $\binom{9}{2} (0.4)^3 (0.6)^7$

10. a) $(0.5)^4$ b) $6(0.5)^7$ c) $210(0.5)^{10}$