MATH2561: Probability and Statistics

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Unit 3: Questions

QUESTIONS

1) Five fair coins are flipped. If the outcomes are assumed independent, find the probability mass function of the number of heads obtained?

2) It is known that screws produced by a certain company will be defective with probability 0.01, independently of one another. The company sells the screws in packages of 10 and offers a money-back guarantee that at most 1 of the 10 screws is defective. What proportion of packages sold must the company refund?

3) In a gambling game, known as the wheel of fortune (or chuck-a-luck), a player bets on one of the numbers 1 through 6. Three independent fair dice are then rolled, and if the number bet by the player appears i-times, where $i = 1, 2, 3$, then the player wins i units; if the number bet by the player does not appear on any of the dice, then the player loses 1 unit. Is this game fair to the player? (that is, whether the expected gain is zero, positive, or negative).

4) A and B play a game in which their chance of winning are in the ratio of $3 : 2$. Find A's chance of winning at least three games out of the five games played?

5) Ten fair coins are thrown simultaneously. Find the probability of getting at least seven heads?

6) 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, a student must secure at least 75% correct answers. If there is no negative marking, what is the probability that the student secures a distinction?

7) Suppose that the number of typographical errors on a single page of this book has a Poisson distribution with parameter $\lambda = 0.5$. Calculate the probability that there is at least one error on this page.

8) Consider an experiment that consists of counting the number of α particles given off in a 1-second interval by 1 gram of radioactive material. If we know from past experience that on the average, 3.2 such α particles are given off, what is a good approximation to the probability that no more than 2α particles will appear?

9) Earthquakes occur in the western United States according to a Poisson process with rate of 2 per week. Then, (a) what is the probability that at least 3 earthquakes occur during the next 2 weeks? (b) what is the probability distribution of the waiting time (from now) until the next earthquake?

10) In a book of 520 pages, 390 typo-graphical errors occur. Assuming Poisson law for the number of errors per page, find the probability that a random sample of 5 pages will contain no error?

11) If X is a Poisson variate such that

$$P(X = 2) = 9P(X = 4) + 90P(X = 6). \tag{1}$$

Find the parameter λ, and the mean of X?

12) A call center receives calls at an average rate of 3 per hour. (a) What is the probability that exactly 2 calls arrive in an hour? (b) What is the probability that no calls arrive in the first 30 minutes?