

# CS 107 Section B - Probability

Spring 2019, AUA

## Homework No. 08

Due time/date: 10:35AM, 29 March, 2019

**Note:** Supplementary Problems will not be graded, but you are very advised to solve them and to discuss later with TA or Instructor.

**Note:** Please provide your answers in the form of a decimal number, by calculating and simplifying fractions, with the accuracy of 2 digits after the period.

**Problem 1.** My Financial Mathematics exam program at YSU consists of 50 questions, and I am preparing for the exam 50 small paper pieces, writing a question on one side of the paper, one question for each piece of paper. A student knows the answers for 20 questions from that program. During the oral exam, he is taking at random a paper piece with a question, and is answering, if he knows the answer. After answering or not answering to the question, this student is returning the exam question paper back into the basket of questions, and then taking another question at random to answer. I assume that answering the same question is OK for me, if the student is taking the same question twice, and I am allowing to take as many questions as the student wants<sup>1</sup>. The student passes the exam, if he is answering correctly to one question. Let  $X$  be the number of trials (of taking a question) the student will do to pass the exam.

- What is the distribution of  $X$  ?
- What is the probability that the student will pass my exam doing no more than 7 trials?
- What is the probability that the student will not pass my exam at all?
- (Supplementary) What about the parts **a.** and **b.**, if I am asking to answer 2 (or, say, 3) questions correctly to pass the exam?
- (Supplementary) What about the parts **a.** and **b.**, if I am not allowing to return back the taken question?

**Problem 2.** I am rolling 3 dice 350 times<sup>2</sup>. In each roll, I am interested to have at least 2 sixes - this is my success in one trial. For the total experiment of 350 rolls, I am interested in the number of successes I will have. Let  $X$  be the number of successes in 350 trials.

- What is the distribution of  $X$ ?
- I want to approximate  $X$  using the Poisson distribution. What is the parameter (rate)  $\lambda$  I will use for the Poisson distribution to approximate the distribution of  $X$ ?

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<sup>1</sup>Well, this is from a kind of scientific fiction series, of course ☺

<sup>2</sup>Tiresome job, of course. There is nothing I would not do for a good Problem ☺

- c. What is the exact probability that the number of successes will be in between 30 and 33?
- d. What is the Poisson approximated probability that the number of successes will be in between 30 and 33? Calculate the numbers using some math software and compare with the above probability.

**Problem 3.** We consider the number of car accidents during 10AM till 6PM in the Arshakunyats avenue. The average number of accidents is, say, 0.6 (for example, in average, we "have" 6 accidents in 10 days during that time interval). Let  $X$  will be the number of car accidents during 10AM till 6PM tomorrow in the Arshakunyats ave. .

- a. Model the probability distribution of  $X$ ;
- b. What is the probability that the number of car accidents for tomorrow during the above time interval on the Arshakunyats ave. will be more than 2?
- c. What is the probability that we will not have any car accidents tomorrow during the above time interval on the Arshakunyats ave.?

**Problem 4.** Assume one of our local taxi services is receiving in average 0.5 phone calls during 1 min interval. Let  $X$  be the number of calls that taxi service is receiving in a **10 min** interval.

- a. Model the probability distribution of  $X$ ;
- b. What is the probability that our taxi service will not receive any calls during the next 10-min interval?
- c. What is the probability that our taxi service will receive more than 20 calls during the next 10-min interval?

**Problem 5.** (from [R]) Solve the Problem 4.52, page 167.

**Problem 6.** (from [R]) Solve the Problem 4.55, page 167.

**Problem 7.** (from [R]) Solve the Problem 4.60, page 167.

**Problem 8.** (from [R]) Solve the Problem 4.61, page 167.

**Problem 9.** (from [R]) Solve the Problem 4.63, page 167.

**Problem 10.** (from [R]) Solve the Problem 4.75, page 168.

**Problem 11.** (Supplementary, from [R]) Solve the Problem 4.16 page 170.

**Problem 12.** (Supplementary, from [R]) Solve the Problem 4.17 page 170.