CS 107 Section A - Probability

Spring 2020, AUA

Happy first Probability Homework!
Hope you will enjoy solving them.

Homeworks Grading Policy

We will grade homework with the following strategy: for each homework we will select several (possibly all) problems to grade (this set will be the same for all CS 107 Section A students, but with high probability will not coincide with the previous set). The total grade of 100 points for each homework will be distributed among these selected problems.

In case you'll want to check if you have solved ungraded problems correctly, you are welcome to visit your instructor's or TA's Office Hour to discuss your solutions.

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Spring 2020, AUA

Homework No. 01

Due time/date: 09:35AM, 31 January, 2020

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

Problem 1. Which of the followings can be considered as a random (probabilistic) experiment? Explain your reasoning. Describe the sample space for each experiment, and explain your reasoning for the choice of that space.

a. One of our local taxi services wants know the number of taxi calls for tomorrow.

b. I am playing an American roulette[1] and I have made a bet on Low (i.e., I will win if the ball will stop at a number between 1 and 18). The roulette is turning now, and I want to know (guess) the result before it will stop.

c. We want to consider the distribution of the grades for our Probability course, i.e., we want to know how many A, B, C, D or F grades we will have at the end of our course (we have 27 students in our Section).

d. I have a the list of grades for my previous Probability course, and I am calculating the Maximum.

e. From the box full of white and red balls I want to pick 2 balls at random. I am interested in the result. **Note:** Be sure to consider two possible cases (when the order is important and is not).

f. I have a portfolio consisting of 100 Alphabet Inc. (Google, ticker: GOOG) shares and 300 Apple (ticker: AAPL) shares. I want to know the closing price of my portfolio for Sept 1, 2020.

g. I want to compare my last semester Stat course average grade with my previous Stat course average grade to see which one is larger.

Problem 2. Consider the following Experiment: I am tossing a coin 4 times, and I am interested in the number of heads I will have in that experiment.

a. Describe the Sample Space for this Experiment;

b. Describe, as a subset of the Sample Space, the following event: I will have even number of heads in my experiment.

c. Describe, as a subset of the Sample Space, the following event: I will not have any heads in my experiment.

[1] See `https://en.wikipedia.org/wiki/Roulette`

Problem 3. Consider the following experiment: I am tossing a coin until the heads will show up. And I want to calculate how many tosses I will perform for that.

a. Describe the Sample Space for this Experiment;

b. Describe 2 different Events for this Experiment;

c. Describe mathematically, as a subset of the Sample Spaces, the following Event: the number of tosses until I will get heads is between 3 and 5.

Problem 4. Assume our experiment is to choose one natural number from the interval $[1, 100]$, so the Sample Space is

$$\Omega = \{1, 2, 3, ..., 100\}.$$

We consider the following events:

- A=the chosen number is divisible by 20;
- B=the chosen number is even;
- C=the chosen number is from [10,20].

Describe the following events:

a. $A \cap B$;

b. $C \setminus B$;

c. $A \cup C$;

d. $A^c \cap C$.

Problem 5. We consider the Darts[2] game, our Darts board is a circle with the radius $d = 30$cm, and our game payoff is the following: if my missile will hit the Darts board at the distance x cm from the center, I will get $\$1000 * (30 - x)$. Describe a suitable Sample Space for this Experiment (game), represent the Sample Space as an infinite union of mutually exclusive (i.e., pairwise non-intersecting) nonempty events.

[2]https://en.wikipedia.org/wiki/Darts