Bootcamp: Probability & Statistics for Machine Learning

Assignment 1

Prof. Moustapha Cisse and Tutors
Due 22 Feb. 2023, 9:00 a.m

Instructions:

- The work you hand in must be your own. You are permitted to collaborate with one another students only to the degree of giving ideas on how to solve a problem. Think through and write up your own solutions; copying from others is not permitted. In particular, the code you hand in must be your own.
- Put in enough (and only enough) detail so that someone else in the class could read and understand your solution. A solution which consists of simply a correct answer with no working are not satisfactory.
- The "math" part of the assignment may be done by hand (make sure it is neat and legible) or may be typed up.
- You should hand in a physical copy of your assignment if it is done by hand otherwise, send it together with the codes.

Question 1

Let flip three coins (head: H and Tail: T) at the same time. Let X be a random that counts the number of heads.

1. What is the cardinal of the sample space Ω.
2. Find the sample space Ω of the the experiments.
3. Find $X(\Omega)$ and the probability distribution f of X.

Question 2

Given a random variable X and its probability distribution is given by:

x	1	2	4	6
f(x)	0.2	0.5	0.1	0.2

1. Find $F(1.5)$ and $F(2.1)$
2. Find $P(x > 4.5)$ and $P(1.5 \leq x \leq 4.5)$.
3. Draw the graph of the cdf of X.

Question 3

Given a probability distribution $f(x)$ for a random variable X. Find and sketch $F(x)$. $f(x) =$

$$\begin{cases} 2x & \text{for } 0 \leq x \leq 1 \\ 0 & \text{Otherwise} \end{cases}$$

Find and sketch $F(x)$.

Question 4

X,Y	1	2	3	4	5	6
0	1/36	3/36	0	0	0	0
1	0	0	4/36	4/36	4/36	4/36
2	0	0	1/36	3/36	5/36	7/36

1. Find the marginal distributions of X and Y;
2. Find the conditional distribution of X given that $Y = 2$;
3. Compute the covariance between X and Y;
4. Compute the coefficient correlation between X and Y;
5. Is X and Y are independent? Explain why or not?