

Introduction to Probability, Statistics and Data Handling	Joint distribution
Tutorial 4	

1. Let X be random variable with distribution in the table.
Random variable $Y = X^2$. Are X and Y dependent?
Calculate covariance between X and Y .

X	-1	0	1
p	1/3	1/3	1/3

2. Lets throw two symmetric dice. Let X be the number of 6s we get, and Y the number of 1s.
Find:
a) Joint distribution of random variables (X, Y) and random variables X and Y . Are they independent?
b) correlation between X and Y ,
c) Distribution of $X + 2Y$.

3. In the table below, the number of the people (per 100 000 population, per year) that smoked cigarettes and had lungs cancer is presented. The random variable X is one (not smoking) or zero (smoking) and variable Y is 1 (healthy) and 0 (ill). What are the joint distribution and marginal functions? Calculate:

- a) the probability that if a person is ill it was caused by cigarettes,
b) is he/she smokes that has lungs cancer,
c) correlation between X and Y ,
d) probability that the smoking person will have cancer in: i) five, i) fifty years.

	smoking	not smoking
ill	80	8
not ill	44920	54992

4. A RV X has a mean value $E(X)$ and variance $V(X)$. Determine the expected value and variance of a new random variable $Z = \frac{X-E(X)}{\sigma}$
5. Let X and Y be jointly continuous random variable with joint pdf:

$$f_{X,Y}(x, y) = \begin{cases} 6e^{-(2x+3y)}, & x, y > 0 \\ 0, & \text{otherwise} \end{cases}$$

- a) Are X and Y independent?
b) Calculate the correlation between X and Y .
b) Find marginal distribution of X and Y .
c) Find $P(X > 2)$ and $P(Y < 1)$.
d) Find $P(Y/X > 1)$.