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 $\boldsymbol{X}$ is one (not smoking) or zero (smoking) and variable $\boldsymbol{Y}$ is 1 (healthy) and 0 (ill). What are the joint distribution and marginal functions? Calculate:

	smoking	**not smoking**
ill	80	8
not ill	44920	54992

   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.

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:

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

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