Statistics and Stochastic Processes Exam 2017.10.27.

1) Calculate the joint and marginal distributions, check the independence of X and Y, calculate the means, covariance and correlation coefficient and make conclusion on the dependence (direction and strength) of X and Y . (10 points)

X\Y	3	4	5	6
2	22	24	31	19
3	20	25	29	28
4	30	32	33	21

2) An experiment has outcomes *red, yellow, green, blue* and *black* with probabilities 0.15, 0.22, 0.19, 0.23 and 0.21. Give the probability of, if the experiment is repeated 39 times independently, then we have exactly 7 *red,* 9 *yellow,* 8 *green,* 11 *blue* and 4 *black* outcomes. (5 points)

3) The weights in a sample of a products are
20.0, 20.1, 20.1, 20.2, 20.4, 20.5, 20.7, 20.9, 21.0, 21.1, 21.3, 21.4, 21.4, 21.4, 21.4, 21.5 .
Give an interval estimation for the mean of this weight with confidence level 95% . (5 points)

4) Decide the hypothesis "$\sigma^2 = 0.5$" with significance level 0,95 for the above statistical sample. (5 points)

5) We tossed 4 coins (together) many times and get the distribution of the heads in the table. Are the coins fair with significance 95% ? (10 points)

nu. of heads (i)	0	1	2	3	4	total
frequency (a_i)	10	65	140	79	20	

6) Calculate the linear regression line for the dataset with the least square method. (5 points)

x_i	1	1.5	2	3	4	4.7
y_i	10	13	22	35	39	50

7) Give the stochastic model of the following computer program, where x_0,K<N are given parameters:
X:=x_0; for t:=1 to T do begin; X:=X+Rnd()*K; if X>N then X:=X-N; end; (5 points)

8) The car's 'computer' samples the speed in every minute and displays the average of the last 10 measurements as "average speed". Give the stochastic model of this displayment and describe its type. (5 points)

Total: 50 points

Statistics and Stochastics Processes Exam
2018.10.19

1. Calculate the joint and marginal distributions, check the independence of X and Y, calculate the means, covariance and correlation coefficient and make conclusion on the dependence (direction and strength) of X and Y. (10 points)

X/Y	5	6	7
1	35	41	23
2	27	32	36
3	30	17	48
4	45	38	42

2. We found a deck of Hungarian cards. Unfortunately a few cards are missing. We only have:

   - Acorn: VII, VIII, IX, X
   - Leaves: VII, VIII, IX, Under, Over, King, Pig
   - Bells: VII, VIII, IX, X, King, Pig
   - Hearths: VII, X, Under, Over, Pig

   Given an experiment: we pull a card out of our incomplete deck. We write down what suit/color is the card then we put it back into the deck and mix the deck. After a few experiments we notice that so far we pulled: 5 acorns, 4 leaves, 9 bells, 3 hearts. What is the probability os this outcome? (5 points)

3. We are working in a factory that produces "PĂ¶ttyĂ¶s Ă„riĂ˘s TĂşrĂł Rudi"-s. We are provided with the weight measurements of sample products:

$$\text{Let } \{X_1, \ldots, X_n\} = \left\{ \begin{array}{lllllllll} 50.2 & 50.4 & 50.5 & 50.7 & 50.7 & 50.8 & 50 & 50.8 & 50.9 \\ 51.0 & 51.0 & 51.2 & 51.3 & 51.5 & 51.5 & 51.6 & 51.7 & \end{array} \right\}$$

   Give an interval estimation for the dispersion of these weight measurements with confidence level 95%. Decide if these samples meet the standards. (5 points)

4. The business standard demands that the means of the samples must be above 51g with significance level 99%. Decide if the above mentioned statistical sample meets the standard. (5 points)

5. In a technological process we measure the temperatures at two distinct locations.

First point $[^oC]$:	54.4	54.3	54.3	54.5	54.4	54.3	54.4
Second point $[^oC]$:	54.2	54.0	n.a.	54.1	54.2	54.1	54.2,

   where n.a. means that there is no data because of some error and suppose that the dispersion values are identical. Check weather the two measured temperatures are the same, if the deviations are only caused by accidental measurement errors($\epsilon = 5\%$).(5 points)

6. We want to experiment with a robot that follows a previously drawn fading line on the floor. The robot's sensor measures light intensity, but we need the distance from the middle of the line(the darkest points). If the device is inside the line strip, the relationship between the measured (l) light intensity and the distance from the middle point (y) is linear: $l = a_1 y + a_0$. We have a set of measurement points:

Distance from center (y):	0	0.005	0.01	0.015	0.02
Light intensity (l):	379	438	565	647	713

Determine a_1 and a_0! (5 points)

7. The number of failures $N(t)$, which occur in a computer network over the time interval $[0, t)$, can be described by a homogeneous Poisson process $\{N(t), t \geq 0\}$. On an average, there is a failure after every 4 hours, i.e. the intensity of the process is equal to $\lambda = 0.25$. What is the probability of at most 1 failure in $[0, 8)$, and at least 2 failures in $[8, 16)$, and at most 1 failure in $[16, 24)$ time intervals? (5 points)

8. A gambler plays a game in which he either wins one chip with probability p or loses a chip with probability $1 - p$. Assume he quits when he either goes broke of attains a fortune of F dollars. Give the stochastic model of this phenomena. Suppose $F = 5$, if he starts out with 2 chips, how would you determine the probability that he will be broke within 4 plays? No exact results are needed, just the thought process.(5 points)