

PROBLEMS FOR EXERCISES IN RANDOM PHENOMENA COURSE - 2ND SET

1. Three players are playing darts. Number of hits of fields with different scores is presented in the table below. Draw graphs of the corresponding probability mass functions and the cumulative distribution functions for each of the players. Calculate the mean and variance of the score for each player.  
 R:  $\langle X_1 \rangle = 1.79$ ,  $\langle X_2 \rangle = 3.63$ ,  $\langle X_3 \rangle = 9.75$ ,  $\sigma_1 = 2.19$ ,  $\sigma_2 = 3.54$ ,  $\sigma_3 = 1.22$

score	0	1	2	3	5	10
number of hits by player 1	30	23	17	16	5	4
number of hits by player 2	14	18	20	14	9	20
number of hits by player 3	0	50	0	2	2	91

2. Consider shooting at the target, where the probability of hitting the target is 0.3 for every shot. At least how many times should we shoot to hit the target at least once with the probability of 0.9? R:  $N = 7$
3. 3% of roof tiles are too porous. We randomly select twenty tiles.
- What is the probability that two of them are too porous? R:  $P = 0.099$
  - What is the probability that no more than two of them are too porous? R:  $P = 0.980$
4. A manufacturer has determined that 80% of the new products will work without malfunctioning for the first 100 days.
- What is the probability that at least nine out of ten products will work without malfunctioning for the first 100 days? R:  $P = 0.376$
  - The manufacturer sells five series of ten products. What is the probability that in four series at least nine products will work without malfunctioning for the first 100 days? R:  $P = 0.062$
5. A system for detecting faults in the material is checked. The system on average correctly detects only every fifth fault. How many faults should there be for the system to detect at least one with a probability of at least 0.95? R:  $n = 14$
6. Products are packed in boxes that contain 100 pieces. Among the products there are 0.7% defective. What is the probability that a randomly selected box holds more than two defective products? R:  $P = 0.0336$  and  $P = 0.0341$
7. Number of applications for repairing a product is Poisson distributed with the average of three applications per week.
- What is the probability that we get more than four applications in a randomly selected week? R:  $P = 0.185$
  - It is estimated that on average in one third of applications the repair is not needed as the application is a consequence of the user's lack of knowledge. What is the probability that there will be no more than five repairs in four weeks time? R:  $P = 0.191$
8. It is assumed that the potholes in the road surface are Poisson distributed with the average of three potholes per 20 km of the road.
- What is the probability that no more than four potholes are found in the 30 km long road section? R:  $P = 0.532$
  - What is the length of a road section without potholes with the probability of at least 0.9? R:  $l = 0.703$  km
9. It is assumed that the number of errors along the drawn wire is Poisson distributed with the average error frequency of 1 per 5 m of the wire.
- What is the probability that in 20 m wire length there would be no more than two errors? R:  $P = 0.238$
  - Wire is cut into 1 m long pieces. What is the probability that among the ten randomly selected pieces no more than three will have at least one error? R:  $P = 0.910$