Probability & Statistics Midterm Examination Retake, May 20, 2020

Problem 1 (20 minutes)

ξ, η and ς are independent random variables with $\exp(\lambda)$ distribution.

Find the probability density of

(a) $\xi+\eta$;

(b) $\xi+\eta+\varsigma$.

Justify your answer.

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Problem 2 (20 minutes)

A symmetric six-sided die is rolled until

(a) one gets two sixes in a row;

(b) one gets two identical numbers in a row.

Find the expected number of rolls in each case.

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Problem 3 (25 minutes)

The joint distribution of (ξ, η) is given in a table below:

η \ ξ	-1	0	1	3
1	0,05	0,15	0,1	0,35
2	0,1	0,05	0,05	0,15

Find (a) the correlation coefficient $\rho_{\xi,\eta}$;

(b) the conditional expected value $E((\xi-\eta)^2|\xi)$

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Problem 4 (15 minutes)

It is known that $P(|\xi - E\xi| < 1) = \frac{6}{7}$ for an exponentially distributed random variable ξ. Find $E\xi$.

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Problem 5 (15 minutes)

The first marksman hits the target with probability $p_1 = 0,6$, and the second marksman with probability $p_2 = 0,8$ (both probabilities are indicated for a single shot; all the shots are independent of each other).

One of the marksmen is chosen at random, and both the first and the second shot are misses. Find the probability that his next two shots are hits.

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Problem 6 (20 minutes)

Random vector $(a; b)^T$ is uniformly distributed in a rectangle $|a-3b| + |a+3b| \leq 18$. Find the probability that equation

$$x^2 + ax + b = a$$

(a) has exactly one solution;
(b) has two (different) solutions.