Middle East Technical University — Department of Computer Engineering

CENG 222

Statistical Methods for Computer Engineering

Spring 2019-2020

Homework 2

version 1

Due date: 12 04 2020, Sunday, 23:59

Introduction

In this assignment, there are 3 questions related to the 3^{rd} and the 4^{th} chapters in your text book. While answering the questions, please **show your work** and the steps of your calculations. Give an explanation about what numbers mean in those steps. When you take numbers from distribution tables, explain how you chose those numbers. Otherwise, you may not get any point.

Questions

$P(x,y)$		x		
		0	1	2
y	0	$1/12$	$4/12$	$1/12$
	2	$2/12$	$2/12$	$2/12$

Table 1: The joint probability table of discrete random variables X and Y.

Q1. (*40 pts.*) The joint probability distribution of discrete random variables X and Y can be seen in Table 1. According to it, please do the following.

a) (*8 pts.*) Calculate $\mathbf{E}(X)$, $\text{Var}(X)$.

b) (*7 pts.*) Find the probability mass function of $X + Y$.

c) (*9 pts.*) Calculate $\text{Cov}(X, Y)$.

d) (*7 pts.*) Show that for random variables A and B, if A and B are independent, then, $\text{Cov}(A, B) = 0$.

e) (*9 pts.*) Show whether or not X and Y in this question are independent.

Q2. (*30 pts.*) At a pen production factory, a pen is broken with probability 0.2, independent of the other pens. We want to test whether pens are broken or not.

a) (*10 pts.*) Among 12 pens, what is the probability that at least 3 of them are broken?

b) (*10 pts.*) Compute the probability that the fifth pen we test will be the second broken pen we find.

c) (*10 pts.*) On average, how many pens we are going to test to find 4 broken pens?

Q3. (*30 pts.*) Bob gets a phone call every 4 hours on average. The time until the first phone call and the times between two consecutive calls are independent exponential random variables.

a) (*10 pts.*) What is the probability that Bob doesn't get a phone call for at least 2 hours?

b) (*10 pts.*) What is the probability that for the first 10 hours, Bob gets at most 3 phone calls?

c) (*10 pts.*) Given that Bob did not get more than 3 phone calls for the first 10 hours, what is the probability that he does not get more than 3 phone calls for the first 16 hours?

Specifications

- You are expected to write your answers in LaTeX format. You can use the given template.
- Please do not skip the calculation steps. Show every step of your work.
- You have a total of 3 late days for this homework. For each day you have submitted late, you will lose 20 points. The homeworks you submit after 3 late days will not be graded.
- Cheating is forbidden. The violators will be punished according to the department regulations.
- Follow the course page on COW for any updates and clarifications. Please ask your questions on COW instead of e-mailing if they do not contain some part of the solution. If they contain some part of the solution, you can send an email to "artun@ceng.metu.edu.tr".

Submission

Submissions will be done via ODTUCLASS. If you do not have access to ODTUCLASS for some reason, please send an email to assistants about that. You are expected to submit a zip file named "hw1.zip" that contains both **your latex source** and also **the compiled version of it in pdf format**.