Middle East Technical University | Department of Computer Engineering

CENG 222

Statistical Methods For Computer Engineering

Spring '2017-2018

Take Home Exam 3

27 May 2018, Sunday, 23:55

In the early years, many of the CENG students who took Artificial Intelligence course, found out a gate to my universe. They programmed an autonomous agent to destroy my mainframe computer, Skynet, and closed the gate to prevent my minions to arrive to this world. However, it is not easy to prevent such invasion of mine. Now, you found out that the gate is not shut down completely and my robot minions are coming out of the gate. So, you statistics students are trapping some of my minions popping out of the gate and in an hour number of minions you caught is a Poisson random variable with $\lambda = 4$.

Now, you started to investigate them in order to find weak spots for annihilation. There are two features you will be checking namely (W)eight and (S)peed having the joint pdf:

$$f_{W,S}(w,s) = wse^{-w-s}, \qquad w > 0,\ s > 0$$

Question 1

Perform a Monte Carlo study to estimate the probability that the number of minions you caught in 5 hours having the relationship $W >= 2 * S$ is bigger than 6. With probability 0.95, your answer should not differ from the true value by more than 0.005. Use Normal approximation to determine the size of your Monte Carlo simulation.

Question 2

Based on the study in part 1, estimate the total weight of the minions you caught in 5 hours.

Question 3

Assume that you are investigating new independent features $A \sim exp(2)$ and $B \sim N(0,1)$. Compute the Monte Carlo estimate of $\mathbf{E}[(A+2B)/(1+|B|)]$.

Submit your Matlab source code and a short report that describes the Monte Carlo study and answers the questions in parts (1), (2), and (3).

1 Regulations

1. You have to write your answers to the provided sections of the template answer file given. Other than that, you cannot change the provided template answer file. If a latex structure you want to use cannot be compiled with the included packages in the template file, that means you should not use it.

2. Do not write any other stuff, e.g. question definitions, to answers' sections. Only write your answers. Otherwise, you will get 0 from that question.

3. **Late Submission: Not Allowed**

4. **Cheating: We have zero tolerance policy for cheating**. People involved in cheating will be punished according to the university regulations.

5. **Newsgroup:** You must follow the newsgroup (news.ceng.metu.edu.tr) for discussions and possible updates on a daily basis.

6. **Evaluation:** Your latex file will be converted to pdf and evaluated by course assistants. The .tex file will be checked for plagiarism automatically using "black-box" technique and manually by assistants, so make sure to obey the specifications.

2 Submission

Submission will be done via COW. Download the given template file, "the3.tex", when you finish your exam upload your codes and .tex file compressed in a file named the3.zip or the3.tar.gz to COW.
Note: You cannot submit any other files. Don't forget to make sure your .tex file is successfully compiled in Inek machines using the command below.

```
$ pdflatex the3.tex
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