

Data-Driven Mobility Modeling and Simulation (CUSP-GX9007)

HW #4 Due 04/25/2018

Computation and Data¹:

1. **MC Question:** User Monte Carlo integration technique to estimate

$$\int_a^b (2.9\sqrt{x} - x^2) dx$$

- a. To at least 3 post-decimal digits of accuracy, what is the true integral value when $a = 0$, $b = 2$? **(5 Pts)**
 - b. Using $n = 100$, 1000 , and $10,000$, estimate (via MC) the integral for the two combinations of a and b in part (a). Please keep in mind that the area of the plot is different than 1. **(10 Pts)**
 - c. Comment on the relative accuracy of the two settings. Explain any significant differences. **(5 Pts)**
2. **MCMC Question:** In this question, you are supposed to find a desired solution which is one that gives the highest likelihood. You are not graded on finding the whole quote but may receive bonus 5 points if you do.
- a. Please download a book from Project Gutenberg (<http://www.gutenberg.org>) to create a transition matrix. Please include the book you downloaded to your submission and add the transition matrix plot to your answer sheet. **(10 Pts)**
 - b. Please decode the coded movie² quote below. Please add the final decoded version of the quote to your answer sheet. **(10 Pts)**
 - c. Please double the jump probability and re-run the MCMC process. Comment on the results. **(10 Pts)**

codedQuote="RQG LWY C AGG CR CF YOP WXG BOCJB RO EPCDM W RCVG VWNQCJG CJRO W NWX
LQYJOR MO CR LCRQ AOVG ARYDG"

3. **Conservation Law:** Considering the following road section with different sensor stations, test the conservation law. You need to run the simulation code and check the results at different time steps (a time step represents 5 minutes in actual time). The data set is:
d04_text_station_5min_2013_01_05.txt.gz
- a. Using sensor 401529 as the input sensor and sensor 401613 as output sensor, check the results at time step = 65 to see whether the conservation law holds or not, and insert the final chart. **(15 Pts)**
 - b. Repeat above step but use sensor 401613 as input and sensor 400536 as the output, check the results at time step = 65 (Note: The section length is 0.59 miles now. You need to update the length variable dX in code). **(15 Pts)**
 - c. Comment on the results of above two questions. **(20 Pts)**

¹ Please feel free to contact kaan.ozbay@nyu.edu or ak4728@nyu.edu if you have any questions and/or concerns.

Your submission must include your R code as well as your PDF file containing all of your plots. Please do not upload any plots separately. While markdown files are not required, you may receive bonus points for submitting them.

² 1.21 Gigawatts