MAT2580 - Project

1   Introduction

The Port Authority of New York and New Jersey (PANYNJ) manages several maritime ports in the NY/NJ area (see Figure 1), including:

- Brooklyn Marine Terminal (BMT)

- Red Hook Container Terminal (RHCT)

- Port Jersey (PJ)

- Port Newark (PN)

- Elizabeth-Port Authority Marine Terminal (EPAMT)
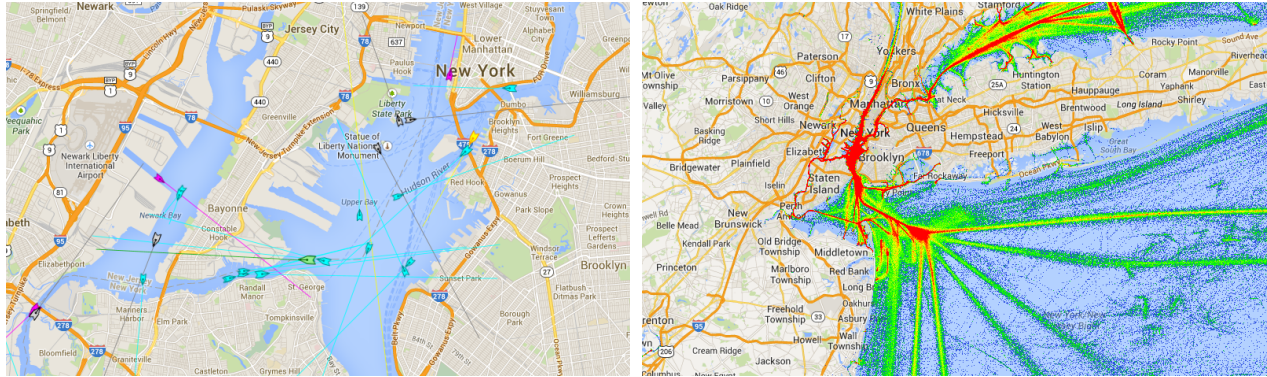
- Howland Hook Marine Terminal (HHMT)

Figure 1: PANYNJ ports.[1]

A significant amount of local marine traffic of various kinds (tugboats, tankers, personal craft, etc.) use these ports and travel between them on a daily basis (see Figure 2a and Figure 2b).

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[1]http://www.panynj.gov/port/about-port.html

(a) A sample of maritime traffic.

(b) Maritime traffic density.

Figure 2: Maritime traffic in the NY/NJ area.[2]

The goal of this project is two-fold:

1. To develop a matrix model that describes the quantity of local ships using the various ports handled by the PANYNJ and how traffic flows between them.

2. To examine the long-term behavior of local port usage and marine traffic if current trends persist.

2 Data

The table below (Table 1) represents the recently-observed average daily transition proportions of local ships in the NY/NJ area. For example, the 2% in row 1, column 4 means that, on an average day, 2% of all local ships at Port Newark traveled to the Brooklyn Maritime Terminal the following day.

	BMT	RHCT	PJ	PN	EPAMT	HHMT	Other Ports
BMT	8%	16%	18%	2%	21%	19%	35%
RHCT	12%	12%	22%	14%	22%	6%	12%
PJ	30%	5%	3%	24%	14%	26%	7%
PN	14%	26%	12%	15%	2%	16%	15%
EPAMT	20%	5%	13%	1%	10%	27%	7%
HHMT	3%	28%	20%	33%	7%	2%	15%
Other Ports	13%	8%	12%	11%	24%	4%	9%

Table 1: Transition percentages.

The following table (Table 2) gives a count of the total number of local ships at each port on April 28, 2014.

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[2]http://www.marinetraffic.com/en/

BMT	RHCT	PJ	PN	EPAMT	HHMT	Other Ports
26	34	23	76	34	86	34

Table 2: Local ship count at each port on April 28, 2014.

3 Task

In this project, you will work in groups of 3 to 4 on a technical report. Using the data given above, your goals are to:

- Construct a matrix model
$$\mathbf{x}_n = A\mathbf{x}_{n-1}, \text{ for } n \geq 1,$$
  that describes the local maritime traffic flow over time in the ports managed by the PANYNJ.

- Use any methods from class to determine the number of expected vessels in each port in 3 months and decide which port may be in need of extra resources (manpower, equipment, etc.) to handle an large increase in traffic.

4 Report Template

Reports should be double-spaced in 11 pt New Times Roman font. Outside of the cover sheet and abstract (see below), the report should not exceed 3 pages.

Your report should contain each of the following sections:

- Cover Page - The cover page should include the names of the people in your group as well as the title of the project report.

- Abstract - The abstract should appear on its own page. This should be a one-paragraph summary of the paper. It should state the problem you are studying, the methodology used to solve it, and the end results.

- Introduction - Briefly introduce the problem. What are you looking to solve? What is the point of your paper?

- Assumptions and Definitions - List any assumptions you make on the given data and explain why they are reasonable. Also, include any definitions you need (including mathematical definitions) for the next section.

- Analysis - Explain what methods you used to solve the problem mathematically. You do not have to show every step in your computation, but you should explain what you did to arrive at your result.
  Example: "Using MATLAB, we computed the eigenvectors of A to be..."

- Interpretation and Conclusion - This section should summarize your results and address all questions posed. Explain what your results mean and what you can conclude from them.

5 Grading

The report is due **MAY 14**. Grades will be assigned out of 50 points using the following criteria:

- (25 points) Mathematical content - This includes appropriate methods and computations.

- (5 points) Assumptions - This includes making reasonable and necessary assumptions for your matrix model.

- (10 points) Conclusion - This includes how you answer the questions posed and whether or not they are reasonable based on your computations.

- (10 points) Organization - This includes making sure that the template was followed, neatness, and appropriate grammar.