1.221J / 11.527J / ESD.201J Transportation Systems

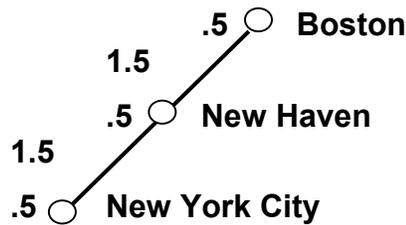## FALL 2002

FINAL EXAMINATION
(30 points)

90 minutes

QUESTION 1 (22 points)

This question deals with a simplified high-speed rail service in the Northeast Corridor.

In Option A, the service has three stops, in Boston, New Haven and New York City.

OPTION A

```
                              .5 ◯  Boston
                     1.5
                       .5 ◯  New Haven
                 1.5
           .5 ◯  New York City
```

The link travel times are 1.5 hours between each pair of cities in both directions. The time it takes to service the train at each node is 0.5 hours.

People in Boston and New York City are interested in better service between these two major cities and suggest *not* stopping in New Haven. This is Option B.

OPTION B

```
                              .5 ◯  Boston
                  2.5
           .5 ◯  New York City
```
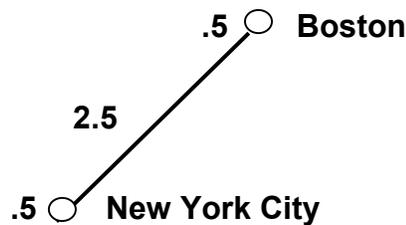
The travel time between Boston and New York City in both directions is now 2.5 hours. The time it takes to service the train in Boston and New York City is still 0.5 hours.

1. (1 point)

   Calculate the train-cycle for Option A and Option B.

2. (1 point)

   How many trains do you need to operate 12 trains/day uniformly distributed throughout the day for Option B?

3. (1 point)

   With that number of trains, what frequency can you provide for Option A, with the trains uniformly distributed through the day?

If the numbers come out non-integer, go back and check your work!

Here is some additional information.

The following is a matrix of K coefficients used for estimating demand between each pair of cities.

K MATRIX

	Boston	New Haven	New York City
Boston	X	50	200
New Haven	50	X	100
New York City	200	100	X

Here is the FARE Matrix -- FARES IN $.

FARE MATRIX

	Boston	New Haven	New York City
Boston	X	100	200
New Haven	100	X	100
New York City	200	100	X

The demand between any pair of cities is

$$D = \frac{K \bullet FREQ}{T \bullet FARE} * 1000 \qquad \begin{array}{l} \text{FREQ in trains/day} \\ \text{T in hours} \\ \text{FARE in \$} \end{array}$$

where

T is the travel time between those cities;

K is taken from the **K Matrix** for that city pair;

FARE is taken from the **FARE Matrix** for those two cities.

To make the calculations simpler, the system is perfectly symmetrical with respect to direction of travel.

4. (2 points)

    Calculate the demand between all pairs of cities for both Options A and B.

NOW, you are ready to answer the real question!

5. (8 points)

    YOU ARE THE TRAIN COMPANY. SHOULD YOU STOP AT NEW HAVEN ?

    Do whatever further calculations you need to and indicate whether or not you would stop at New Haven and explain why.

6. (6 points)

NOW, considering *only Option B*, and considering the travel time and train service times and the K matrix as *fixed*, explore some changes to this service and suggest which changes are a good idea.

7. (3 points)

   Suggest some shortcomings in the model used in this analysis.

<u>**QUESTION 2**</u> (8 points)

Please read the article, "Mayor Urging Drivers Toward Mass Transit", (modified from "Mayor Sets a New Tone, Pushing Drivers Toward Mass Transit", by Randy Kennedy, *The New York Times*, March 26, 2002) and respond to the questions below.

1. (4 points)

    Explain the article in terms of any of the 30 Key Points, but no more than *4*.

2. (4 points)

    There are many ways to lower highway and street congestion. Choose 3 and discuss them in a paragraph each. You may choose ways to lower congestion *not* mentioned in the article.