

Trip to New York City

Part 1 - The yellow taxicab course

On september 1st, you have just arrived at John Fitzgerald Kennedy airport (Terminal 1) in New York City (NYC). It is 9pm and your first goal is to get to your hotel, located at number 45, West 44th Street in Manhattan.

You decide to take a yellow taxicab, and on your way you want to estimate the cost for this journey.

These documents come from the NYC official website (<http://www.nyc.gov>), the Port Authority of New York and New Jersey (<http://www.panynj.gov>), and the Metropolitan Transportation Authority (<http://web.mta.info>).

Document 1 - Yellow Taxicab rate: metered fare.

- Onscreen rate is "Rate #01 - Standard City Rate."
- The initial charge is \$2.50.
- Plus 50 cents per 1/5 mile.
- There is a 50-cent MTA State Surcharge for all trips that end in New York City.
- There is a 30-cent Improvement Surcharge.
- There is a daily 50-cent surcharge from 8pm to 6am.
- There is a \$1 surcharge from 4pm to 8pm on weekdays, excluding holidays.
- Passengers must pay all bridge and tunnel tolls, at E-ZPass rate.
*(You may refer to **documents 2 & 3** about the tolls.)*
- Please tip your driver for safety and good service.
(You may choose to tip your driver an extra 20% of total amount.)
- There are no charges for extra passengers or bags.

Document 2 - Tolls for a standard vehicle (PANYNJ).

- Cash tolls at all hours: \$15.00.
- E-ZPass rate at peak hours (on weekdays: 6-10 a.m., 4-8 p.m.; on Saturday and Sunday: 11 a.m.-9 p.m.): \$12.50.
- E-ZPass rate off-peak hours (all other times): \$10.50.

All rates apply to the Lincoln & Holland tunnels, the George Washington, Bayonne & Goethals bridges, and the Outerbridge Crossing. Tolls are collected entering New York.

Document 3 - Tolls for a standard vehicle (MTA).

- Bronx-Whitestone, Throgs Neck & RFK Bridges; Hugh L. Carey & Queens Midtown Tunnels:
 - E-ZPass rate: \$5.76.
 - Tolls by mail: \$8.50.
- Henry Hudson Bridge:
 - E-ZPass rate: \$2.64.
 - Tolls by mail: \$6.00.

1. Using the best maps website you can find, estimate the length (in miles) of the taxicab journey from the airport to the hotel.
2. Calculate and explain the cost of:
 - (a) the initial charge + distance fees;
 - (b) the surcharges;
 - (c) the tolls.
3. Based on the total cost you found before, estimate the total fare, including tips, for this journey.

In fact, the journey from JFK airport to any place in Manhattan is subject to a different fare rate (same source as **document 1**):

Document 4 - Yellow Taxicab rate: JFK.

- Onscreen rate is "Rate #02 - JFK Airport."
- This is a flat fare of \$52.
- There is a 50-cent MTA State Surcharge for all trips that end in New York City.
- There is a 30-cent Improvement Surcharge.
- There is a \$4.50 rush hour surcharge (4 PM to 8 PM weekdays, excluding legal holidays).
- Passengers must pay all bridge and tunnel tolls, at E-ZPass rate.
(*You may refer to **documents 2 & 3** about the tolls.*)
- Please tip your driver for safety and good service.
(*You may choose to tip your driver an extra 20% of total amount.*)
- There are no charges for extra passengers or bags.

4. Re-calculate the taxicab total fare using this new rate.

You have arrived at the hotel. Now that you have understood how the taxicab fares are calculated, you want to estimate the cost of any journey you may do in Manhattan (with no toll).

5. Based on the distance x of the journey, give the expressions of the following functions :
- (a) $f(x)$, the cost of the journey off-peak hours during day time;
 - (b) $g(x)$, the cost of the journey during peak hours;
 - (c) $h(x)$, the cost of the journey at night.
6. **BONUS** : *Modify these three expressions assuming that the distance x is now expressed in kilometers, and the cost in euros.*