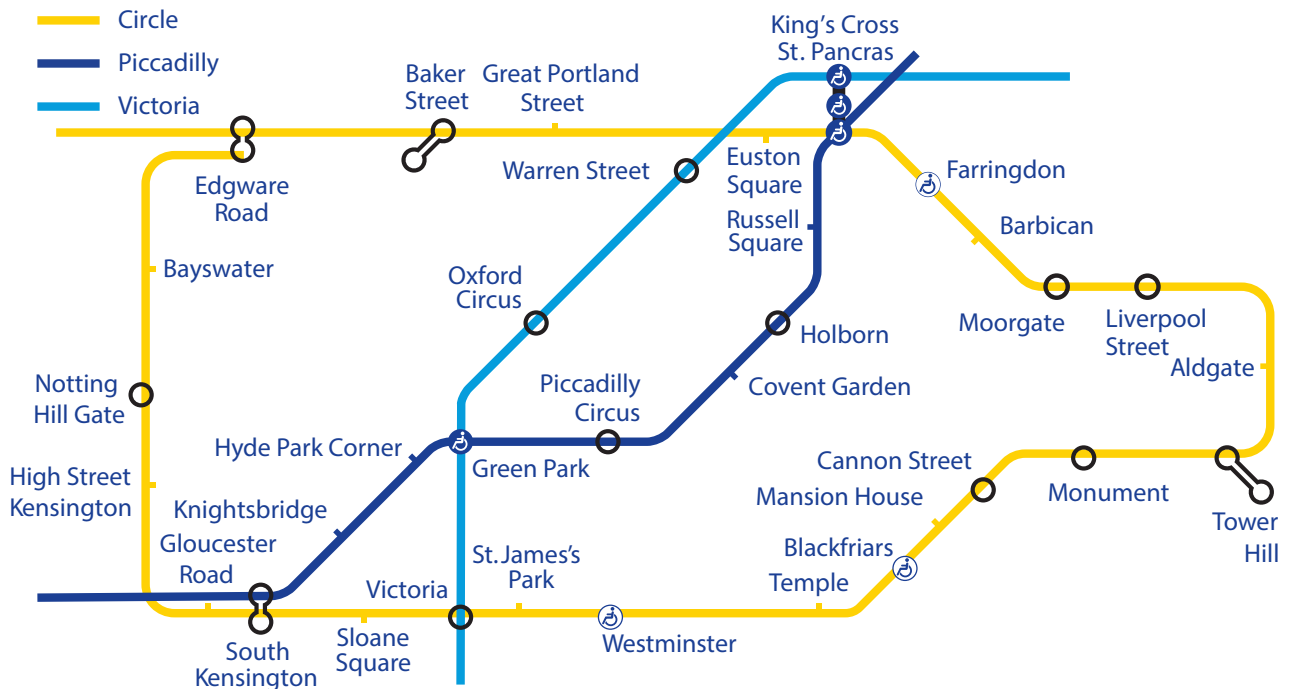


# Homework 7

Due: October 10, 2019

Name:

1. (15 points) **Traveling salesman problem.** You are a lazy and underpaid courier in the city of London. Your job is to deliver packages to King’s Cross, Green Park, South Kensington, and Victoria stops riding on the underground. You must visit each stop once and only once to drop off your packages and return to the starting station. You are allowed to visit intermediate stops more than once if necessary. You are only allowed to ride on the Piccadilly, Circle, and Victoria lines (pictured below). The goal is to find the shortest circuit, measured in total stops.



- (a) (5 points) Draw a graph of all stops that need to be visited—King’s Cross (KGX), Green Park (GP), South Kensington (SK) and Victoria (V)—and the edges that connect them.

- (b) (5 points) Enumerate all circuits that visit King's Cross (KGX), Green Park (GP), South Kensington (SK) and Victoria (V). For each circuit, indicate (1) the order of stops, (2) which line you use to travel between each stop, and (3) the total distance in terms of intermediate stations for that circuit. I have done the first one for you.

KGX-Circle 8 Stops-SK-Circle 2 Stops-V-Victoria 1 stop-GP-Piccadilly 5 Stops-KGX 16 stops total

- (c) (5 points) Among all the circuits you enumerated in part (b), which has the fewest number of total stops?
2. (25 points) Design a finite state machine controller for a Turing Machine that XORs two binary numbers of arbitrary length. Assume that the first number starts at the beginning of the tape and the bits of second number are interleaved with the first. In the diagram below of the input, the first number is shaded white and the second is shaded gray. You can put the result anywhere you want on the tape, but it's probably easiest to overwrite one of the two inputs. Make sure you include a halt state that the controller goes to when it has completed its operation.

