SogetiLabs Global Programming Contest

Problem Statement and Rules

sogeti labs
Part of Capgemini

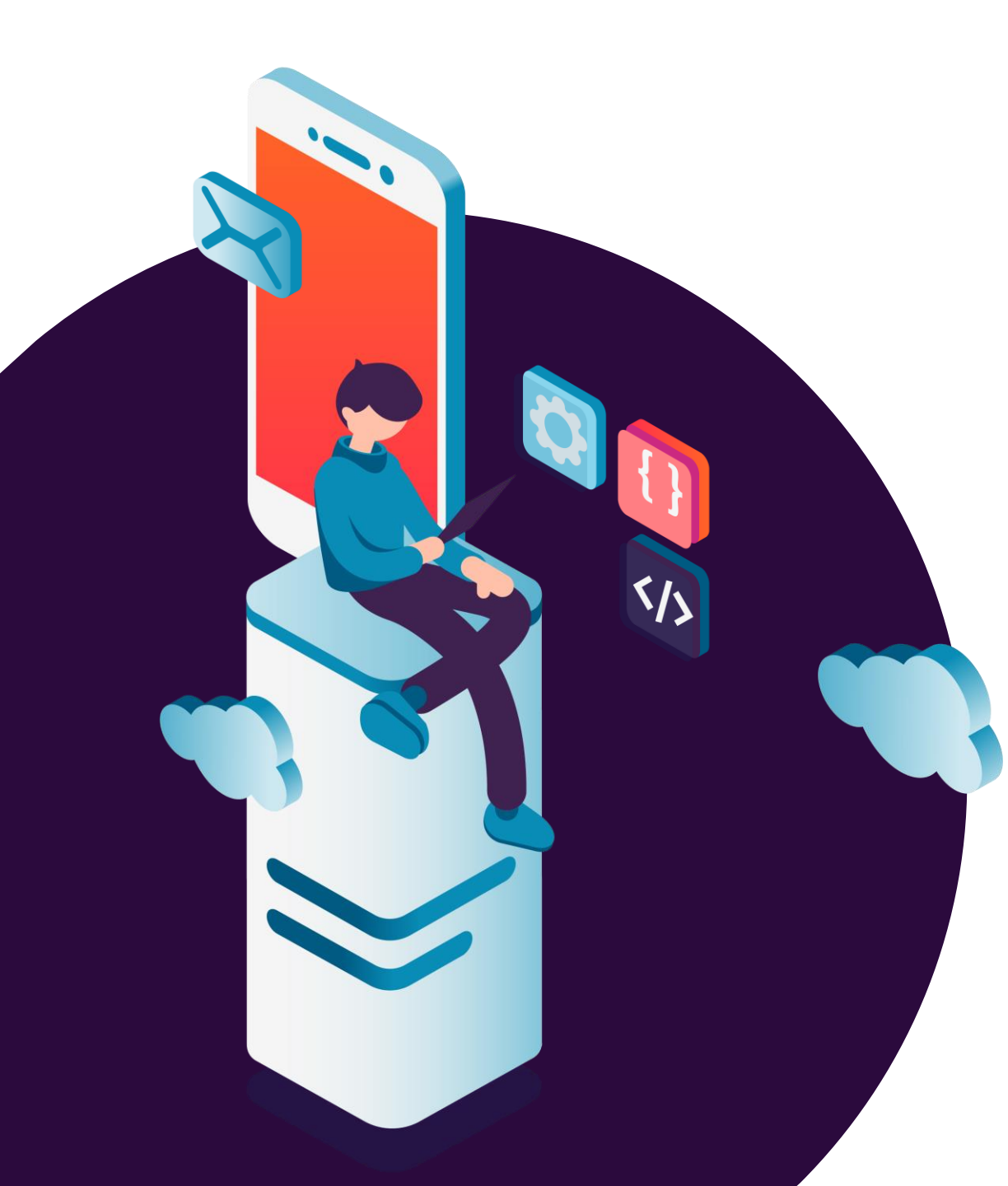
intel

Introduction

- You are in charge of a new **bicycle rental company** implanted in several cities, and would like to maximize your revenue by positioning your bikes in each town and selecting the rental requests in the best way possible.

- Each completed rental will give you a **fixed** amount of money (depending on the city), to which is added an amount **proportional to the ride distance**.

- You also own **trucks** in some cities, which allow your company to move bicycles around to anticipate demand.



Technical description

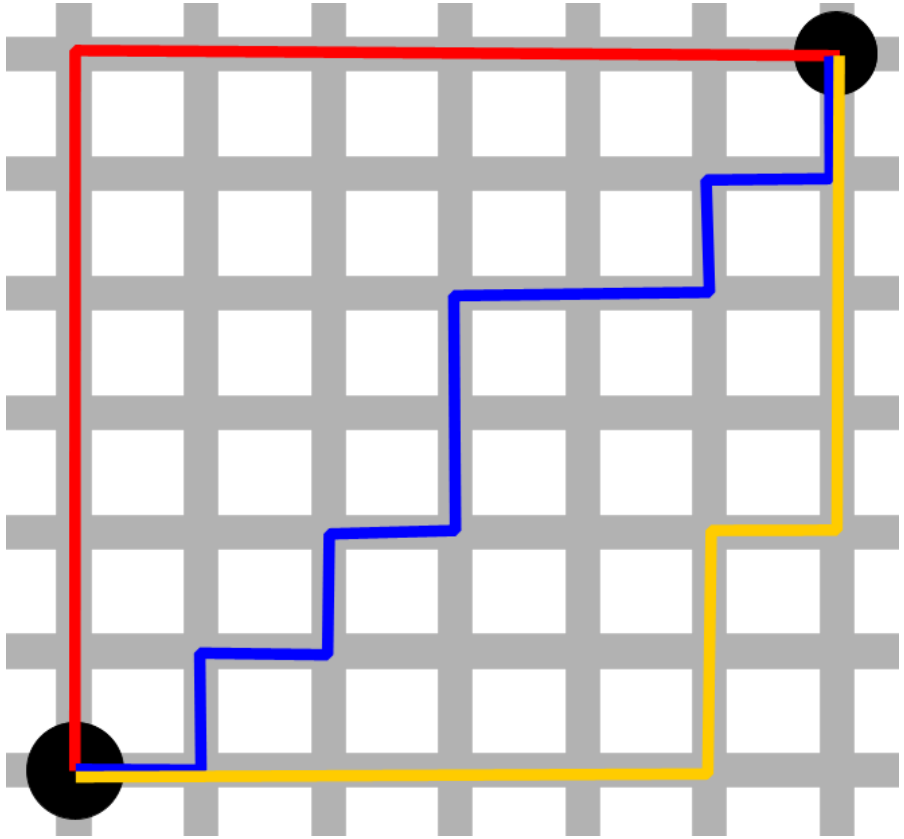
Each city where your company operates will be described in an independent dataset. The scores of your best submission for each city will be added together for your total score.

The technical details of the challenge will be described in this section.

City

- Each city is a grid of horizontal and vertical streets, where each street is represented by a **non-negative integer coordinate**.

- The intersection between vertical street of coordinate **x** and horizontal street **y** will be noted [x, y]. In order to compute the distance between intersections [xa, ya] and [xb, yb], we use **Manhattan distance** defined as **|xa - xb| + |ya - yb|**, where |v| is the absolute value of v.



Various shortest paths in a city, all have a Manhattan distance of 12.

Credit : Wikimedia

Bicycles

- Each bike in your fleet can cover **2 units of distance each minute**, non-integer times are rounded up. This means a customer will need 4 minutes to cover the 7 units of distance between [10, 3] and [5, 5] on a bicycle.

- There are two ways of moving a bicycle:
  - By a customer during a rental
  - Using a truck owned by your company

- You can choose the initial position of your bicycles in the city.

Trucks

- Trucks move at the same speed as bikes (2 units of distance per minute) and have a **maximum bike capacity**. All trucks in a given city have the same capacity.

- When a truck is stopped at a street intersection, it can perform any number of actions instantly:
  - Pick up a bike located at the same intersection in its trailer
  - Unload a bike from its trailer to the current street intersection
  - Start driving to another intersection

- You can choose the initial position of your trucks in the city.

Rentals

- All rental requests are **known in advance**, and will be provided to you in each city's dataset. You can select which requests you accept.

- At the time the rental starts, the customer will start walking towards their allocated bicycle at a speed of **1 unit of distance per minute** (if they are not already on the same intersection as the bike). When they reach the bike, the ride begins and the customer will move towards their destination on the bicycle. As soon as the destination is reached, the bike is made available again for another rental.

- For each completed rental, you will earn 1€ for each unit of distance covered **by bicycle** and a fixed bonus which depends on the city.

Rentals

- On the instant a rental is accepted, the bicycle must **already be available** (even if the customer has to walk for a while before reaching it). During the walk, the bicycle is unavailable for other rentals but the walking time is **not billed** to the customer.

- Each rental request is made of four elements:
  - **Rental start time**: you aren't allowed to make a customer wait, each rental must begin at the minute requested.
  - **Customer starting point**, located at an intersection.
  - **Destination**, also located at an intersection. You can't make customers walk after their ride, so the bicycle will always be left at the destination coordinate.
  - **Maximum walking radius**: some customers may accept to walk a long distance to access their allocated bike, while others may need theirs to be exactly at their current location. The maximum walking (Manhattan) distance will be provided for each rental request.

Score

- You will be provided with several datasets, each corresponding to a city where your company operates, some of which will be added **a few days after the challenge starts**. The datasets released on the first day (except the example dataset) will **not have any trucks**.

- For each dataset, your objective is to earn **as much money as possible** over all rentals. In order to validate your revenue for a given dataset, you need to submit a file on the competition platform, which corresponds to rentals and truck movements you have decided to make using the format given in the next section.

- You can make as many submissions as you wish for your team, without penalty. Only the best revenue over all valid submissions will be kept. Your total score is the sum of your scores over all cities.

Score

- In each city, the team having the best revenue will receive 1 million points, and other teams will receive a score proportional to the leading team's score with the following formula:

score = 1,000,000 * (your_revenue / best_revenue)

This means that if your best submission gets you a revenue of 40,000€ for a city and the best submission in the same city over all teams is 50,000€, you will receive 800,000 points.

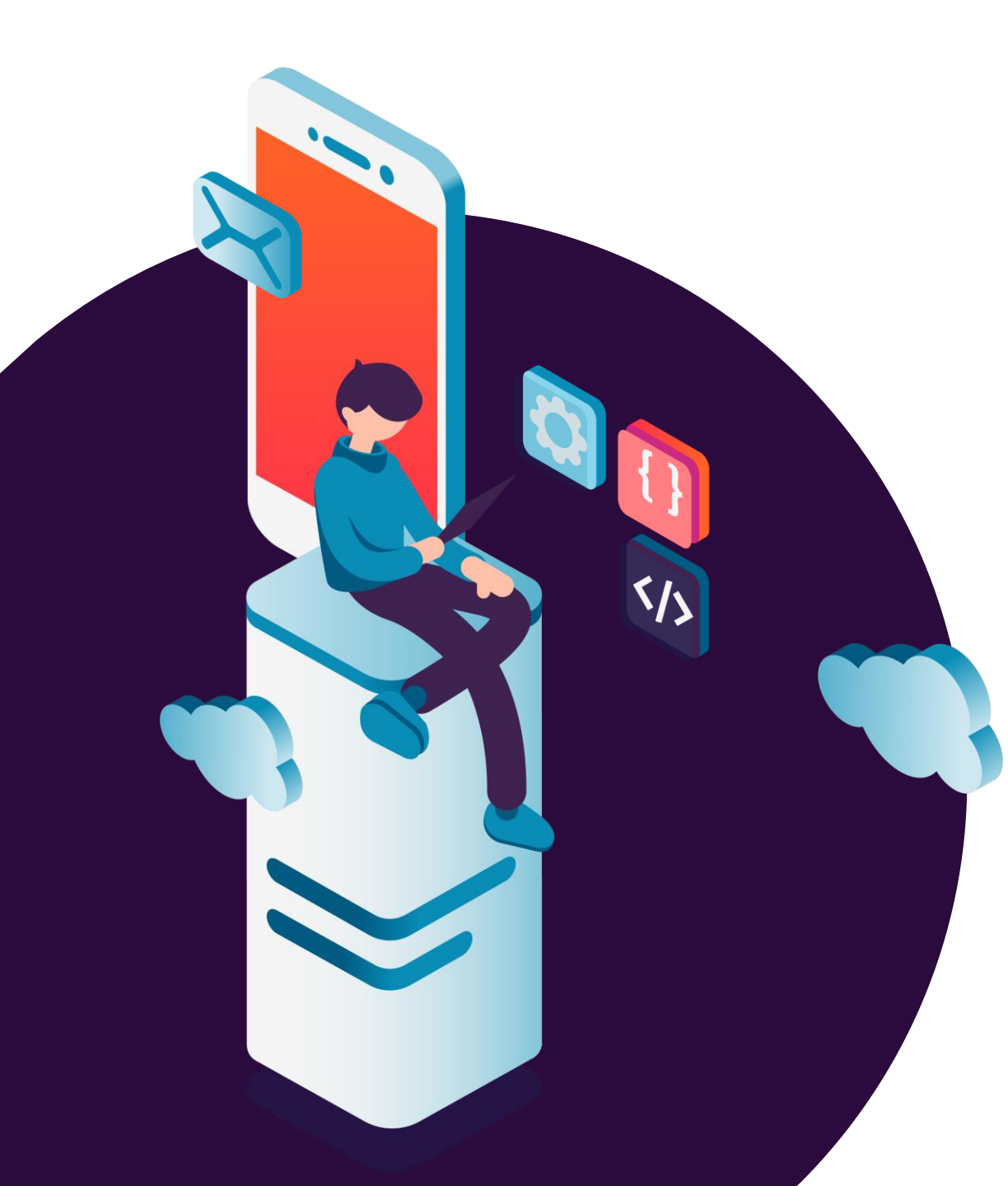
- For the scoreboard between countries, a special scoring formula will be used to ensure a fair tradeoff between the quantity of teams and the quality of solutions. Each team will contribute points to their country’s total based on their total score and their local placement :

team_points * (0.7 ^ (team_place_in_country-1))

Notes

- We recommend to work iteratively, starting with a simple solution that works on any dataset and then improving it to see which techniques work best in each city.

- Each dataset will have its own specificities, and you may need different strategies between cities to maximize your team's total score. It's a good idea to find ways to visualize the several aspects of each dataset in order to refine your strategies.



Input/output formats

Datasets and submissions will follow a simple normalized data format, described in this section.

Dataset

- On the first line, you will be given 5 integers:
  - Number of rental requests are in the dataset
  - Number of bicycles in your fleet
  - Number of trucks available
  - Capacity of bikes in each truck. Will be zero if the city doesn't have trucks.
  - Base price of a rental

- Then, for each rental request, a line with 6 integers:
  - Rental start time
  - Customer starting coordinate, **two integers** x and y
  - Destination, **two integers** x and y
  - Maximum walking distance

Dataset

Example	Comments
4 2 1 2 5	4 requests, 2 bikes, 1 truck, max 2 bikes per truck, base 5€/rental
0 4 2 3 4 1	Rental request at time 0 between [4,2] and [3,4], max. walk distance 1 unit
0 0 3 3 4 2	Rental request at time 0 between [0,3] and [3,4], max. walk distance 2 units
1 9 4 6 6 1	…
3 4 6 7 6 2	

Submission

- Your submission will contain three parts, with an empty line between them. The extension of your file **must be .txt** or it won't be accepted by the platform.

- The first part is the positions where you have chosen to place your bikes initially. Your file will contain one line per bicycle, each line containing two integers representing its coordinates.

- The second part of your submission file is the initial position of each truck, each line containing two integers representing its coordinates.

Submission

- The third and last part of your submission is a list of instructions starting at minute 0, each instruction using one of the five following formats:
  - "**RENT** B*xxx* R*yyy*" : Accept rental request *yyy*, and allocate bike *xxx* to it. The bicycle must be available and within the accepted walking radius.
  - "**PICKUP** B*xxx* T*yyy*" : Pick up bike *xxx* in truck *yyy*. Both need to be at the same coordinate.
  - "**DROP** B*xxx*" : Unload bike *xxx* from the truck that contains it. The truck must not be driving at that time.
  - "**DRIVE** *Txxx aaa bbb*" : Start driving truck *xxx* from its current position to intersection [*aaa*, *bbb*].
  - "**STEP**" : Mark the end of instructions for the current minute and the start of instructions for the following minute.

- For datasets without trucks, you will only need **RENT** and **STEP**.

Submission

Example	Comments
0 3	Bike 0 starts at [0, 3]
4 2	Bike 1 starts at [4, 2]
	Empty line between part 1 and 2
3 4	Truck 0 starts at [3, 4]
	Empty line between part 2 and 3
RENT B0 R1	Allocate bike 0 to request 1 (base 5€ + ride 3€)
RENT B1 R0	Allocate bike 1 to request 0 (base 5€ + ride 4€)
STEP	End of instructions for time 0
STEP	End of instructions for time 1
PICKUP B0 T0	Pickup bike 0 in truck 0
PICKUP B1 T0	Pickup bike 1 in truck 0
DRIVE T0 3 6	Start driving truck 0 to [3, 6]
STEP	End of instructions for time 2
DROP B0	Drop bike 0 from its truck
RENT B0 R3	Allocate bike 0 to request 3 (base 5€ + ride 4€)

Prizes

- At the end of the contest, the team with the highest score overall will receive one laptop per person provided by Intel (value $2000+ each). In case of a tie in points, the team who reached their highest score first will be declared winner.

- Good luck!