Question 1: Origin-Destination matrix

We are analyzing the travel demand among Ecublens, Renens and Bussigny in the morning peak hour. It has been determined that there are 3'000 vehicles leaving and 8'000 vehicles reaching Ecublens, 7'000 vehicles leaving and 7'000 vehicles reaching Renens, and 11'000 leaving and 6'000 reaching Bussigny. What is the origin-destination matrix identifying the number of trips from each city to the others?

Question 2: Boarding and alighting

The IR 90 train line connects Sion to Geneva Airport, via Lausanne. We observe the following flows of passengers:

- 77 passengers alight in Lausanne,

- 85 passengers alight in Morges, 78 of them having boarded in Lausanne,

- 57 passengers alight in Nyon, 35 of them having boarded in Lausanne, and 12 in Morges,

- 180 passengers alight in Geneva, 61 of them having boarded in Lausanne, 9 in Morges, and 39 in Nyon,

- 202 passengers alight at the airport, 49 of them having boarded in Lausanne, 22 in Morges, and 96 in Geneva.

1. How many passengers are on board of the train at its arrival in Lausanne?

2. Among the passengers who boarded the train between Morges and Geneva, what proportion alighted at the airport?

3. Among the passengers who alighted in Geneva, how many passengers originated from a station between Sion and Morges?

Hint: reconstruct the origin-destination matrix for this context.

Question 3: Trip generation

Consider two zones A and B, with the following characteristics:

Variable	Zone A	Zone B
Population	155'000	369'000
Area [km²]	42	75
Jobs	120'000	275'000

A transportation analyst investigates the trips between the two zones. She has developed a model predicting the total number of trips O_i generated by each zone, and another model predicting the total number of trips D_j attracted by each zone:

$$O_i = 0.67P_i,$$
$$D_j = 3.81d_{pj} + 2.76d_{ej},$$

where,

- $i \in \{A, B\}$,

- $j \in \{A, B\}$,

- P_i is the population in zone i,

- d_{pj} is the population density of zone j in [persons/km²]

- d_{ej} is the employment density of zone j in [jobs/km²].

According to the model, how many trips are produced and attracted by each zone?