Exercise 6. Perceived travel cost in private and public transport

In this exercise, please determine the perceived journey cost for a trip between i^{th} (your) and j^{th} (your friend's) traffic analysis zone (TAZ)- in the afternoon peak hour (3 pm) and in the evening (8 pm) for public transport (PuT) and private transport (PrT). Assume that the trip is made between TAZs' centroids and based on this, please determine the travel cost of consecutive trip stages.

To find an optimal connection with *PuT* you can use the trip planner *krakow.jakdojade.pl*. For *PrT*, please use map service which provides typical car travel times for different times of the day (e.g. Google Maps or Targeo.pl).

a) PuT trip stages:

		va	lue	relative	PuT travel cost [PLN]				
trip stage	symbol	afternoon peak	evening off- peak	weight[a _i]	afternoon peak	evening off-peak			
access time from trip origin - to the first stop [min]	t_a			2					
waiting time on first stop [min]	t_w			2					
transfer(s) time [min]	t_t			2					
(in-vehicle) ride time [min]	t_r			1					
egress time from the last stop - to trip destination[min]	t_e			2					
number of transfers [-]	n_t			5					

b) PrT trip stages:

		val	lue	relative	PrT travel cost [PLN]					
trip stage	symbol	afternoon peak	evening off- peak	weight[ai]	afternoon peak	evening off-peak				
access time from the trip origin to car [min]	t_a			2						
ride time [min]	t_r			1						
searching time for SPP1	+	5 min	2 min	2						
parking spot [min] outside SPP	ι_p	2 min	1 min	2						
egress time from car to the trip destination [min]	t_e			2						

c) the perceived journey cost is composed of time costs (i.e. weighted sum of the trip time components multiplied by their respective weights) and monetary costs (i.e. PuT ticket price or PrT parking cost in SPP, and operating/running costs of the private car). These are calculated using formulas below:

$$C_{ij}^{PuT} = \left(a_{t_a}t_a + a_{t_w}t_w + a_{t_t}t_t + a_{t_r}t_r + a_{n_t}n_t + a_{t_e}t_e\right) \cdot C_t + C_{tk}$$

$$C_{ij}^{PrT} = \left(a_{t_a}t_a + a_{t_r}t_r + a_{t_n}t_p + a_{t_e}t_e\right) \cdot C_t + C_p + l \cdot C_e$$

where:

 a_i relative cost weight of a trip stage i t_i time duration of a trip stage i [min] $t_w = \frac{1}{2} \cdot \frac{60}{f}$ expected waiting time on the first stop for $f \ge 6$; for f < 6 assume 5 [min]fservice frequency² [departures/hour]ltrip length [km] C_t time cost factor [0.25 PLN/min]

 C_e operating/running cost factor of the private car [1.00 PLN/km]

 C_{ik} PuT ticket cost(one-way ticket, without discounts)

 C_p PrT parking fee cost in SPP (2 hours)

¹ SPP – paid parking zone

² number of bus/tram departures (per hour) available from the first stop in the direction of trip destination—please consider all possible lines providing connection between analyzed places

In addition, please estimate how will the costs change in afternoon peak hour for scenario nr 1 and one selected scenario:

PuT travel cost [PLN]

- 1. passenger has a free PuT ticket,
- 2. PrT driver has a free parking slot,

3. PrT driver's operating/running costs are covered by his "sponsors".

Please write down all calculations.

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