

### Úloha 1 (Dopravná úloha)

After a snowfall, the snow in each area must be moved out of the district into a convenient location. In Montreal (from where this example is taken), these locations are large grates (leading to the sewer system), a couple large pits, and a couple entry points to the river. Each of these destinations has a capacity. The goal is to minimize **the total distance** travelled to handle all of the snow.

Vzdialenosť z  $i$  do  $j$  v km, kapacity a požiadavky sú v nasledujúcej tabuľke

	Miesto likvidácie snehu			Požiadavka na odvoz [m <sup>3</sup> ]
	Kanalizácia	Jama	Rieka	
Mestská časť 1	2	3	10	1000
Mestská časť 2	3	2	3	2000
Mestská časť 3	4	7	1	2500
Mestská časť 4	9	7	5	1500
Kapacita lokality [m <sup>3</sup> ]	3000	2000	2000	

#### Úloha 1a)

V dôsledku havárie na kanalizácii možno do prvej lokality odviezť maximálne 2000 m<sup>3</sup> snehu. Ako sa zmení riešenie?

#### Úloha 1b)

Upravte model úlohy 1a) tak, aby množstvo neodvezeného snehu v mestských častiach bolo rovnomerne rozložené. (Návod: Minimalizujte najväčší zostatok snehu v mestskej časti.)

### Úloha 2

One of the main products of P&T Company is canned peas. The peas are prepared at three canneries (near Bellingham, Washington; Eugene, Oregon; and Albert Lea, Minnesota) and are then shipped by truck to four distributing warehouses in Sacramento, California; Salt Lake City, Utah; Rapid City, South Dakota; and Albuquerque, New Mexico. Because shipping costs are a major expense, management has begun a study to reduce them. For the upcoming season, an estimate has been made of what the output will be from each cannery, and how much each warehouse will require to satisfy its customers. The shipping costs from each cannery to each warehouse has also been determined. This is summarized in the next table.

Náklady na auto	Veľkoobchod				Kapacita
	1	2	3	4	
Konzerváreň 1	464	513	654	867	75
Konzerváreň 2	352	416	690	791	125
Konzerváreň 3	995	682	388	685	100
Požiadavky	80	65	70	85	

### Úloha 3

Avertz RentACar needs to redeploy its automobiles to correct imbalances in the system. Currently Avertz has too many cars in New York (with 10 cars excess) and Chicago (12 cars excess). Pittsburgh would like up to 6 cars, Los Angeles up to 14 cars, and Miami up to 7 cars (note that more cars are demanded than are available). The cost of transporting a car from one city to another is given by:

	Pittsburgh	Los Angeles	Miami
New York	50	250	100
Chicago	25	200	125

(a) Formulate this problem as a transportation problem. Clearly give the nodes and arcs. For each node, give the supply or demand at the node. For each arc, give the cost. Assume that unmet demand at a city has no cost but that no city can end up with excess cars.

(b) It turns out that unmet demand costs \$50/car in Pittsburgh, \$75/car in LA, and \$100/car in Miami. Update your transportation formulation in (a) to account for this change.