Route Optimization Model
Pathfinder
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Pathfinder models route optimization as a linear programming problem. The function to be optimized and the constraints will be specific to a specific cluster for an application.

Parameters

- $c_{i,j}$ - The capacity of vehicle *i* with respect to parameter *j*.
- $v_{k,j}$ - The value of parameter *j* for commodity *k*.
- $vp_{i,m}$ - The value of routing parameter *m* for vehicle *i*. These are properties of the vehicle that might affect the optimization function, such as gas mileage.
- $cp_{k,m}$- The value of routing parameter *m* for commodity *k*. These are properties of the commodity that might affect the optimization function, such as "passenger priority".
- d_{k_1,k_2} - The driving distance from commodity k_1 to commodity k_2.
- t_{k_1,k_2} - The driving time from commodity k_1 to commodity k_2.
- $d_{i,k}$ - The driving distance from vehicle *i* to commodity *k*.
- $t_{i,k}$ - The driving time from vehicle *i* to commodity *k*.

Variables

- $x_{k,i}$ – 1 if vehicle *i* transports commodity *k*

Problem

$$\min f(d_{k_a,k_b}, t_{k_a,k_b}, d_{i,k}, t_{i,k}, vp_{i,m}, cp_{k,m}), s.t.$$

$$\sum_k v_{k,j} x_{k,i} \leq c_{i,j}, \forall i, j$$

$$\sum_i x_{k,i} = 1, \forall k$$

$$x_{k,i} \geq 0, \forall i, k$$

$$x_{k,i} \leq 1, \forall i, k$$

The difficult part of the problem is determining a suitable function *f*.

Solution

A Julia service solves the optimization problem using the GNU Linear Programming Kit (GLPK, https://gplkjl.readthedocs.org/en/latest/glpk.html). We will use the HttpServer.jl package to expose the routing engine as a web service (https://github.com/JuliaWeb/HttpServer.jl).

An example of a Julia web service that solves a linear programming problem can be seen at https://github.com/aj-michael/sudoku.jl.