Building the Column Generation Loop

Step 0 Compute the parameters u_i^q and δ_{it}^q. There are helper functions to do this.

Step 1 Solve the RMP.

Step 2 Modify the dual for this RMP.
If we look at our dual formulation, we notice that all constraints except one don't depend on what Q is. Instead they are functions on i and t, which means they don't need to be updated if we change Q etc. The one exception, of course, is that one constraint which involves Q: $\sum_i \pi_i u_i^q + \rho + \sum_i \sum_t \mu_{it} \delta_{it}^q \leq C^q \ \forall q$. Since our variable for the model of the dual, modual, has already been calculated, we only need to update this one constraint.

Step 3 Solve the dual and extract the values of ρ, π_i, and μ_{it}.

Step 4 Plug in these values and other parameters to the sp_lsa.

Step 5 Extract the single best route with the most negative reduced cost from the LSA.

Step 6 Find the timestamps associated with the route, as well as the distances. The route should no longer be of the form [location, location, location...] but
[[[location, time], [location, time], dist], [[location, time], [location, time], dist]...]

6.1 The first step is getting the identity of the route which can be done by checking feasibility and changing cost if necessary.

(no longer necessary)
6.2 The second step is to get time information which proceeds as follows:
- First, set all times to be 0. There are as many 0's as there are elements in the best route.
- Then, for each node from 2 to the length of the best route (because the 1 will of course start at time 0):
  - Start with the initial time of the previous node which we will add to.
  - Obtain the location of the previous node.
  - Obtain the load of work from the previous node. If not the depot (which currently says 1), indicate the true workload of the previous node.
  - Now, gather the new location.
  - Compute the total: prev_time + prev_load + distance_to_travel_from_prev_to_new.
  - Finally the maximum of this new total and the window start of the new location is your time info for this time.

Step 7 Add this route to Q.

Step 8 Update all the parameters: every constraint, the objective, Q, n_routes...