Hitachi Hokudai Lab. & Hokkaido University Contest 2020
An example of the summary

(The “transport_only_0” in sample_B.cpp of the toolkit is used as an example.)

- Header

  Screenname: XX

  Submission date: XX.XX.2021

- Body

(1) (a)

Overview

The “transport_only_0” is a simple algorithm that solves problem B by transporting only. In this algorithm, the following processes (i)-(iii) are repeated. (i) Each EV waits on the nanogrid until an order is placed. (ii) When an order is placed, the EV transports customers and goods in order of their order IDs. (iii) After the transportation, the EV moves to the nearest nanogrid and waits for a new order.

Strategy

* Each EV waits on the nanogrid until an order is placed.

  * While the EV waits on the nanogrid, it is charged until its charge reaches a predetermined amount. (The predetermined amount is "safety_energy" on line 438. It is charge for the EV to move for 50 steps.)

* After that, the EV transports customers and goods in order of their order IDs.

  * The EV carries out a maximum of four transportations at once. Although it is desirable for the EV to carry out more transportation at once, the maximum number of simultaneous transports is set to four so that the constraints regarding the number of orders loaded on each EV ($N_{\text{max}}^{\text{trans}}$) can be easily satisfied.

(1)(b)

Implementation

* The actions of each EV are managed by "command_queue" in the source code.

  * In the pseudocode below, the n-ths EV and the corresponding "command_queue" are represented as `EV[n]` and `queue[n],` respectively.

* By using the `move to` function, the move commands to each EV can be simply enqueued in the "command_queue".

* This algorithm is implemented in "transport_only_0" (lines 426-489) and "find_transit_path_greedy" (lines 264-297) in the source code (submission number: XXXX).

<u>Pseudocode</u>

```text
Read the data written in "Input and Output Format 1."
for t = 1 to T_max do
  Read the data written in "Input and Output Format 2."
  for n = 1 to N_EV do
    // Processing to enqueue commands to queue[n]
    if queue[n] is empty
      // Moving EV[n] to the nanogrid and charging EV[n] are priorities to keep EV[n] moving.
      if EV[n] is not on the nanogrid
        if EV[n] does not have enough power left to reach the nanogrid
          Fill queue[n] with 'stay.' // EV[n] will not move anymore.
          continue
        else
          Enqueue 'move' commands for EV[n] to reach the nearest nanogrid in queue[n].
          continue
        end if
      else
        if EV[n] has less electricity than ‘safety_energy’
          Enqueue 'charge_from_grid' commands to queue[n] until EV[n]'s charge reaches 'safety_energy.'
          continue
        end if
      end if

      // Processing for transportation
      if there are one or more orders to which the EV is not assigned
        Assign up to 4 orders to EV[n] in order of order ID.
        Greedy algorithm determines loading and unloading schedule for assigned orders.
        if EV[n] does not have the power needed to transport customers and goods on the schedule
          Enqueue 'charge_from_grid' commands to queue[n] to charge EV[n] until it
```

```
                ... reaches the power needed to transport customers and goods according to the schedule
            end if
            Enqueue 'move' commands to queue[n] so that EV[n] can transport customers and goods according to the schedule
         end if
      end if
      // Output the commands below
      if queue[n] is empty
         Output ‘stay’
      else
         Output a command in queue[n]
      end if
   end for
end for
Read the data written in "Input and Output Format 2."
Read the data written in "Input and Output Format 3."
```

(2) I did not have time, so I could only implement the transport algorithm. However, by using its relatively simple transport algorithm, cars were able to transport customers and goods to some extent. If I could implement the power management algorithm, I think I could get a higher score. The problem statement was long and difficult to read, but I had the impression that it was a problem with a view to practical use, which motivated me to tackle it.