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Project Report

Packages-Are-Us Delivery Service is a system which can help scheduling package pickups and deliveries across Florida. I develop this system using knowledge-based approaches using the forward reasoning inference engine provided by the CLIPS Expert System Shell.

Development environment: CLIPS, Terminal on Ubuntu 12.04

The key part of solving this problem is to simulate how packages are delivered.
First of all, I calculate the shortest paths of cities on the map for future use by Dijkstra Algorithm (implementing in C). Then encoding the data of packages and trucks provided with the paths as original facts. In part 1 I assign a truck to pick up some package which is idle (at Orlando) or will be idle earlier than others (of course it must have room for the coming package). The simulations (dispatching, delivering and return) are immediately generated when a truck is assigned. And then we are able to calculate the results we need by these simulations facts.

In part 2 I just delete the third simulation (return) for each package. In other words, when a truck deliveries a package it won't return to Orlando. Because these packages are located scattered among Florida. If we don't gather the trucks to Orlando(the middle city) after every delivering, we could assign the nearest truck. So that we can save more time according to the probability.

Here are parts of the results of two versions.

DataSet1:

Version1:
Average wait time: 4.26666666666667
On time packages: 24
Late packages: 6
Average lateness of late ones: 6.83333333333333
Average lateness of all: 1.36666666666667

Version2:
Average wait time: 2.0
On time packages: 27
Late packages: 3
Average lateness of late ones: 4.33333333333333
Average lateness of all: 0.433333333333333

DataSet2:

Version1:

Average wait time: 5.46
On time packages: 26
Late packages: 24
Average lateness of late ones: 5.04166666666667
Average lateness of all: 2.42

Version2:

Average wait time: 2.64
On time packages: 39
Late packages: 11
Average lateness of late ones: 3.81818181818182
Average lateness of all: 0.84

DataSet3:

Version1:

Average wait time: 8.6
On time packages: 24
Late packages: 26
Average lateness of late ones: 8.11538461538461
Average lateness of all: 4.22

Version2:

Average wait time: 3.58
On time packages: 39
Late packages: 11
Average lateness of late ones: 3.09090909090909
Average lateness of all: 0.68

From the results above we can figure out that the number of late packages and average wait time are both reduced by about 50% from version1 to version2. Average lateness of all packages are reduced significantly.

The version2 is still too native. There are some other ways to improve the system. For example, we can set 3 or 4 points spread in Florida, say Lake City, Orlando, Miami. After each delivering, a truck will return to its nearest point. This method merge the 2 versions above, and it may work efficiently in some situations.