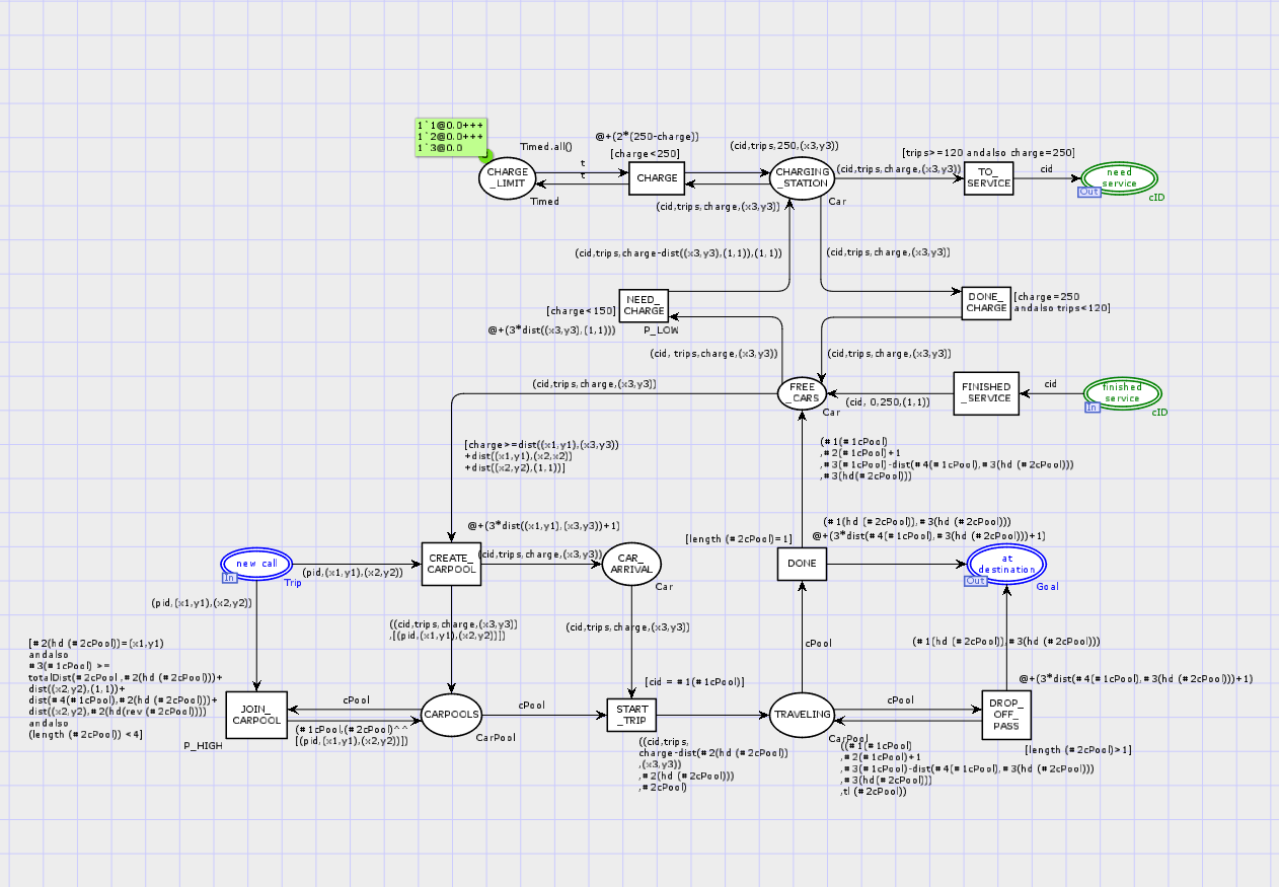
Report CPN Assignment BIS 2IIC0/2IHI10 (2017/2018 Q1)
CPN Assignment 1, Jelle Schukken, 0976141

1 Model



2 Model Description

- After a car completed service in the garage, its car id is available in place (finished service). From there it takes transition FINISHED_SERVICE to place FREE_CARS. FINISHED_SERVICE adds the cid to its corresponding car with full charge and 0 trips and position (1,1).
- From FREE_CARS the car can either go to the charging station and recharge or it can be used to create a new CarPool and start driving to pick it up.
- If the Car has less than 150 charge it can go to the CHARGING_STATION. If it does, its' charge is updated properly. The charging station can charge up to 3 Cars at once. Once a Car has been fully charged, the Car can go back to the FREE_CARS place, or, if it has taken more than 120 trips since the last service, it will go to the need service place.
- When a new CarPool is created it takes a free Car and a Trip. The Trip and the Car are added to the CarPool and the CarPool goes to the CARPOOLS place.
- From the CARPOOLS place two things can happen. One, a new Trip with that same initial position can be added to the CarPool. Two, the corresponding Car can arrive, picking up the Trips, and the CarPool leaves the place. If the CarPool leaves CARPOOLS, its Cars' charge and number of trips are updating respectively.
- Once the CarPool leaves the place, the Trips are dropped off at their destinations (using DROP_OFF_PASS) until no Trips are left in the CarPool. At this point the CarPool dissolves (with transition DONE) and its Car goes back to the FREE_CARS place. The Cars' charge and number of trips are updated respectively during this process.
- Cars can only be added to the CarPools and Trips can only be added to exisiting CarPools if the corresponding charge is sufficient for the car to finish the entire task and still drive back to the charging station.

3 Declarations, Guards, Arc Inscriptions, Functions

3.1 Declarations

trip1	A Variable of type Trip
cPool	A variable of type cPool
tList	A variable of type TripList
TripList	A list of trips representing the passangers in a car pool
t	A variable of type Timed
X3,y3	Variables of type INT
Timed	A timed integer used to limit charging to 3 cars at a time
Car	a collection of information representing a car. A Car contains a cid, an integer representing the amount of trips since the last service, an integer representing the remaining charge, and a location representing the cars current location
CarPool	A collection of variables representing a car pool. A CarPool contains the list of Trips in the pool and the Car that will pick them up
fun totalDist(nil,_) = 0 | totalDist(((trip1:Trip)::tList),s) = dist(s,#3trip1)+totalDist(tList,s) ;	A function used to determine the total distance from s to the destinations of all passangers in TripList tList in order.

3.2 Guards and Arc Inscriptions

Guard/Arc Inscription	Where is it in the model?	Explanation
[#2(hd (#2cPool))=(x1,y1) andalso #3(#1cPool) >= totalDist(#2cPool ,#2(hd (#2cPool)))+ dist((x2,y2),(1,1))+ dist(#4(#1cPool),#2(hd (#2cPool)))+ dist((x2,y2),#2(hd(rev (#2cPool)))) andalso (length (#2cPool)) <4]	This is a guard for the JOIN_CARPOOL transition	This guard checks 3 things. First that the new Trip has the same starting position as the other Trips in CarPool. Second, that the corresponding Car has enough charge to pick up the new Trip. Third that the carpool has enough space left
(#1cPool,(#2cPool)^^ [(pid,(x1,y1),(x2,y2))])	This is the Arc inscription between JOIN_CARPOOL and CARPOOLS	This adds the new Trip to the corresponding CarPool
((cid,trips, charge-dist(#2(hd (#2cPool)) ,(x3,y3)) ,#2(hd (#2cPool))) ,#2cPool)	This is the Arc inscription between START_TRIP and TRAVELING	This moved the Car in the CarPool to the pickup location and adjusts charge appropriately
((#1(#1cPool) ,#2(#1cPool)+1 ,#3(#1cPool)- dist(#4(#1cPool),#3(hd (#2cPool))) ,#3(hd(#2cPool))) ,tl (#2cPool))	This is the Arc inscription between TRAVELING and DROP_OFF_PASS	This moved the car to the destination where it just dropped of a Trip and adjusts charge and number of trips appropriately
(#1(#1cPool) ,#2(#1cPool)+1 ,#3(#1cPool)- dist(#4(#1cPool),#3(hd (#2cPool))) ,#3(hd(#2cPool)))	This is the Arc inscription between DONE and FREE_CARS	This does the same thing as the Arc inscription between TRAVELING and DROP_OFF_PASS except it represents the last Trip in the carpool so it is a Car colorset instead of a CarPool colorset

4 Simulation Results

4.1 Summary of Simulation Results

From the simulation report it can be seen that my model always completes 1000 trips successfully with on average only 120 trips taking too long.

4.2 Raw Simulation Reports

Statistics							
Name	**Avrg**	**90% Half Length**	**95% Half Length**	**99% Half Length**	**StD**	**Min**	**Max**
Cars_in_service							
count_iid	17.000000	0.000000	0.000000	0.000000	0.000000	17	17
max_iid	5.000000	0.000000	0.000000	0.000000	0.000000	5	5
min_iid	0.000000	0.000000	0.000000	0.000000	0.000000	0	0
avrg_iid	0.144934	0.001753	0.002110	0.002843	0.005650	0.133225	0.153942
Passengers_on_trip							
count_iid	2002.000000	0.000000	0.000000	0.000000	0.000000	2002	2002
max_iid	15.833333	1.353533	1.629179	2.195607	4.363511	11	30
min_iid	0.000000	0.000000	0.000000	0.000000	0.000000	0	0
avrg_iid	4.174080	0.073681	0.088686	0.119521	0.237533	3.624269	4.530295
Travel_time_dist_1_to_3							
count_iid	771.366667	3.967805	4.775846	6.436298	12.791385	744	794
avrg_iid	27.178945	0.340272	0.409568	0.551966	1.096967	25.108308	29.085026
max_iid	153.619814	12.860526	15.479562	20.861454	41.459684	89.802189	243.928120
min_iid	4.223778	0.449119	0.540582	0.728530	1.447868	1.872360	6.985692
sum_iid	20963.945742	276.738351	333.095897	448.905766	892.147367	19132.530950	22683.684215
Travel_time_dist_4_to_6							
count_iid	228.633333	3.967805	4.775846	6.436298	12.791385	206	256
avrg_iid	33.884944	0.350328	0.421672	0.568277	1.129384	32.237344	36.642865
max_iid	130.138006	10.755024	12.945276	17.446054	34.671978	72.323956	225.554883
min_iid	6.997951	0.769991	0.926799	1.249026	2.482293	2.000000	11.000000
sum_iid	7746.762660	154.147339	185.539322	250.047125	496.939227	6860.726157	8757.644805
Travel_time_too_long							
count_iid	120.133333	4.784555	5.758925	7.761173	15.424417	86	156
avrg_iid	48.897258	1.639241	1.973072	2.659064	5.284576	41.874624	65.313801
max_iid	158.077469	11.859873	14.275127	19.238264	38.233785	93.075445	243.928120
min_iid	25.111718	0.036702	0.044177	0.059536	0.118321	25.000000	25.443214
sum_iid	5909.130813	358.862309	431.944333	582.121556	1156.898068	3601.217697	8129.677017