

# CS 747

## Assignment 1

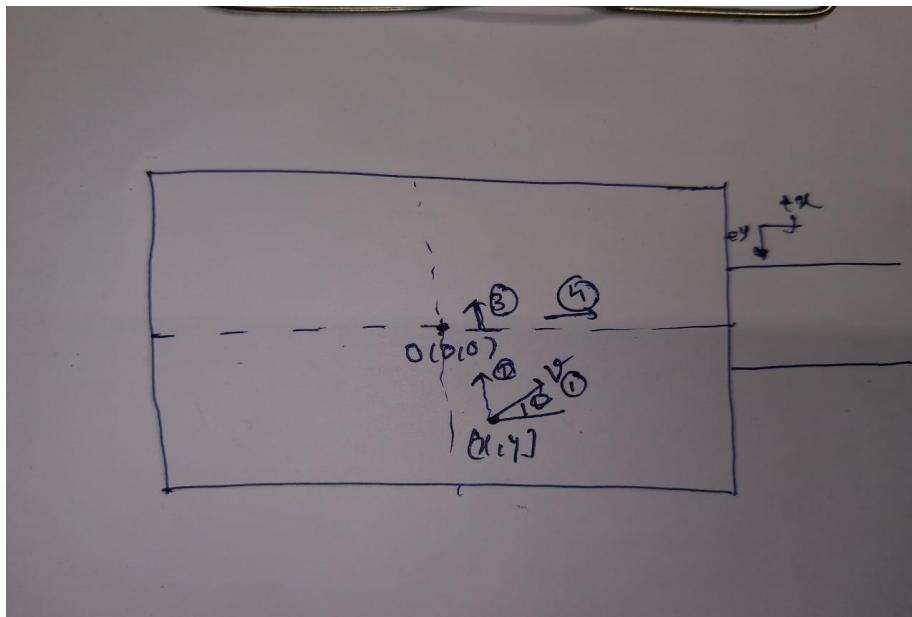
Dhakne Ajay Sopan 190050033

### Task 1: The Parking Lot Problem

We need to get out of parking lot to the road using given actions within efficient amount of steps.

Approach is as follows:

A car can be in any one of four quadrants in any possible co-ordinate as shown in fig car will have an heading angle theta and some co-ordinate (x,y)



Note: {In any general case car will be going through following steps after step 4 it will reach the road 1-2-3-4 (1,2,3,4 mentioned in the figure are not the state numbers)}

if the car is in state  $-30 < y < 30$  : —state 0

Depending on theta it will take its next action if theta is around zero or 360 degree it will move forward with action [1,4] and reach the road(end state) — state 1

If theta is from zero to 180 degree that means it will move in anticlockwise direction(it will take the action [0,0] - first it will decelerate and then rotate) until theta is around zero degree after that it will go to state 1. — state 2

In other case it will take action [2,0] that is rotate anti-clock wise and then go to state 1 once the theta is close to zero.--state 3

If the car is in state  $y \leq -30$  It will rotate itself anticlockwise with action  $[0,0]$  if the theta is between 90 and 270 until theta becomes almost 90 degree . after that it will take action  $[1,4]$  to go to the state 3— state 4

Otherwise it will rotate clockwise with action  $[2,0]$  until theta becomes 90 degree and then go to state 1 with action  $[1,4]$  – state 5

If the car is in state  $y \geq 30$

Depending on theta:

If theta it will take actions  $[0,0]$  or  $[2,0]$  in-order to make the heading angle 270 degree depending on its current heading angle.similar to  $y \leq -30$  case and after that will take action  $[1,4]$  to reach the state 2.

## Task 2: The Parking Lot Problem Intensifies

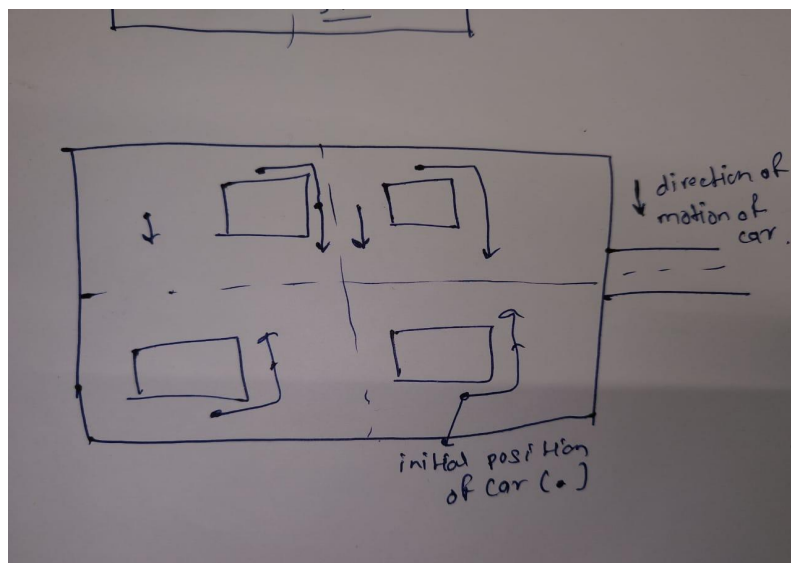
In this task also ,we need to get out of parking lot to the road using given actions within effiecient amount of steps. But there are 4 randomly located pits (100\*100 size) and a narrower road .

First we will find where are car lies (in which quadrant) in order to know the pit centre we need to take into our account.

Note: I have passed the variable `ran_cen_list` as an argument to `next_action` inorder to know the centre co-ordinates of the pit.

Our car will take actions as follows:

We can follow the same procedure as in the task 1 except for the case when the car is in one of following conditions as shown in figure:



When the car is in such position:

i.e when

$((x_p - 55 < x_c < x_p + 55) \text{ and } ((y_c > y_p + 55 > 0) \text{ or } (y_c < y_p + 55 < 0)))$

{ $x_c - 55$  is taken instead of  $x_c - 50$  to account for 5 units of noise}.

Where  $(x_c, y_c)$  and  $(x_p, y_p)$  are the centre co-ordinates of car and pit respectively.

We first move the car to the right as shown in figure.

We take the action [2,2] in-order to move towards right. That is we rotate clockwise until the car is not in position as described in figure.

Once the car is moved to the right we follow the actions as mentioned in the step 1.