(Fill all columns)

College Roll No. ____2017CSC1018_____ Unique Paper Code ____32341601____

Paper Title: _________Artificial Intelligence Practical_______________

Course: B.Sc. ______B Sc Honours Computer Science____________________________

Name of the Student: ___Shivam Harjai____________________________

Assignment File Name ___AI prac____________________

List of Files in the submitted Archive/Bundle in format ZIP / TAR / RAR / 7z etc.

1. q1.pl - prolog file for question 1
2. q2.js - javascript file for question 2
3.
4.
5.
6.
7.
8.
9.
10.

Archive Size in KB : 2

Important: Email your completed /atttempted Assignment to spe_cs@sgtbkhalsa.du.ac.in with *UniquePaperCode-CollegeRollNo* as title of email. For example if UniquePaper Code is 123456 and your College Roll No is 2017PSC1001, title of the email should be 123456-2017PSC1001

(convert this sheet, and may be other files to pdf or jpeg before mailing)

Q - 1 1. Extend the program that you wrote for Assignment – I, adding one additional functional capability. In case you had not done/submitted the assignment earlier, construct afresh with just one most important functionality. (*Brief Statement of Assignment-I Questions are included in the appendix.*). Answer should indicate the extension and its scope clearly.

Ans - Although I submitted a different part of the assignment earlier (part - 2), here I built the third part and expanded on it. I chose to do this because changing the tenses and the voice of a language is relatively easy. To extend the second question any further, would have required to re-write my prolog program so that it understands for other figures of speech/grammar components make up a complex sentence, which I felt was not possible given the time constraint.

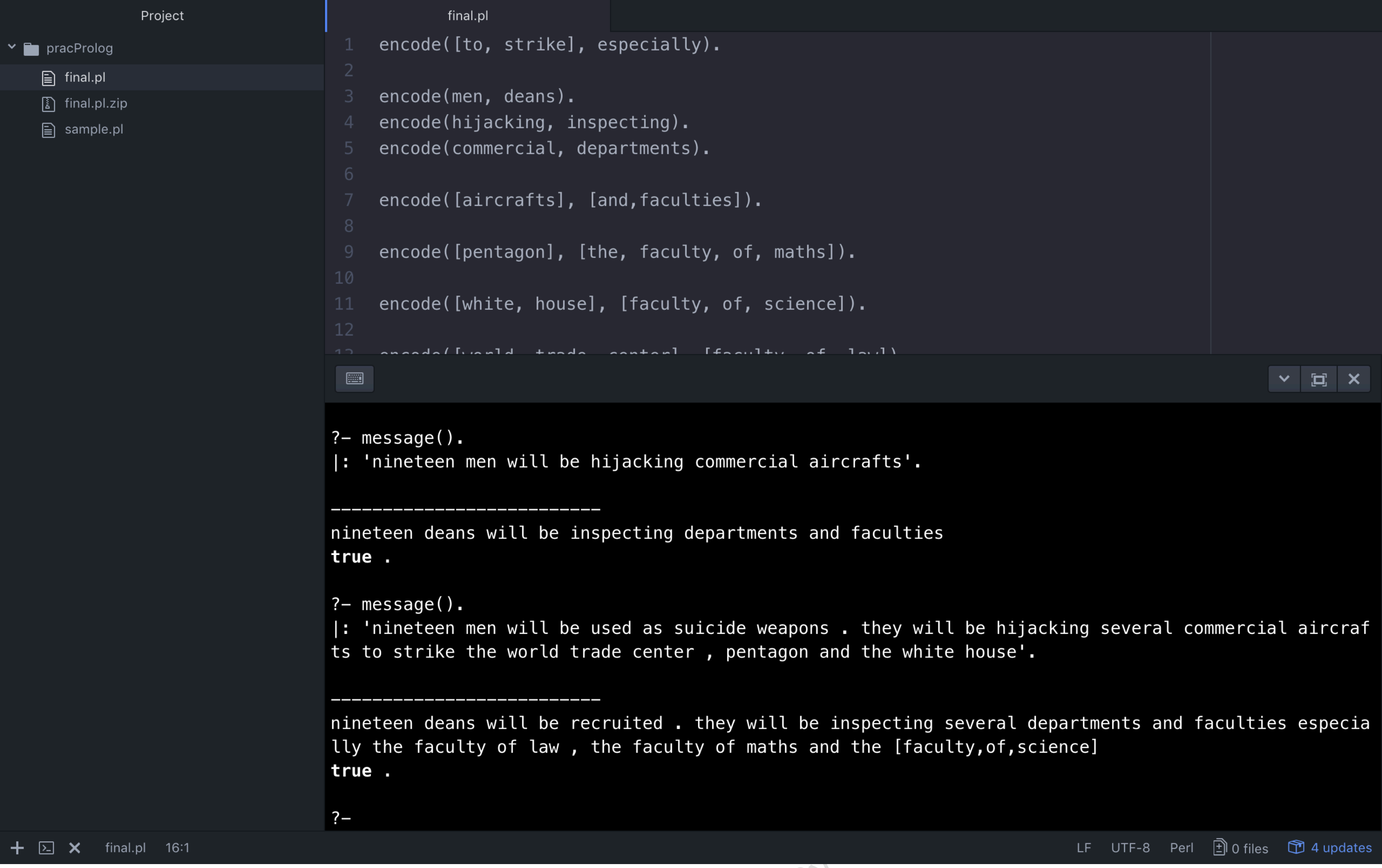
According to the earlier part of the question, if a code-word(word that should not be revealed) appears in the passage given by the user, it must be replaced by the program. It could have been done without ever making a word base, by instructing the prolog program to ignore any other word that it sees ,except the code word. If we were to replace one word by the other, only a dictionary would have been required.
The program could even be taught to ignore/accept a certain word, only after/before a certain number of occurrence.

My extension - What many code-deciphering prolog programs failed to investigate was what if one word was replaced by three or three words were replaced by one. It is a very common trick used by cryptographers, to count the number of alphabets in a word, and make the very strong a assumption that the word they are looking for has exactly that many letters. If you disrupt this however, deciphering a codeword becomes that much difficult.
Therefore I tried to code a system, which takes one code word and replaces it with 4 hardcoded words, or which might take 3 words and replace them with 1 hardcoded word. Any new combination of words requires only 3 lines of new code, and is therefore not that hard.

Also there are several hardcoded essential parts of sentences inside the prolog program so that it can understand the most basic and rudimentary of sentences, and return true, even if they do not contain any of the code-words.

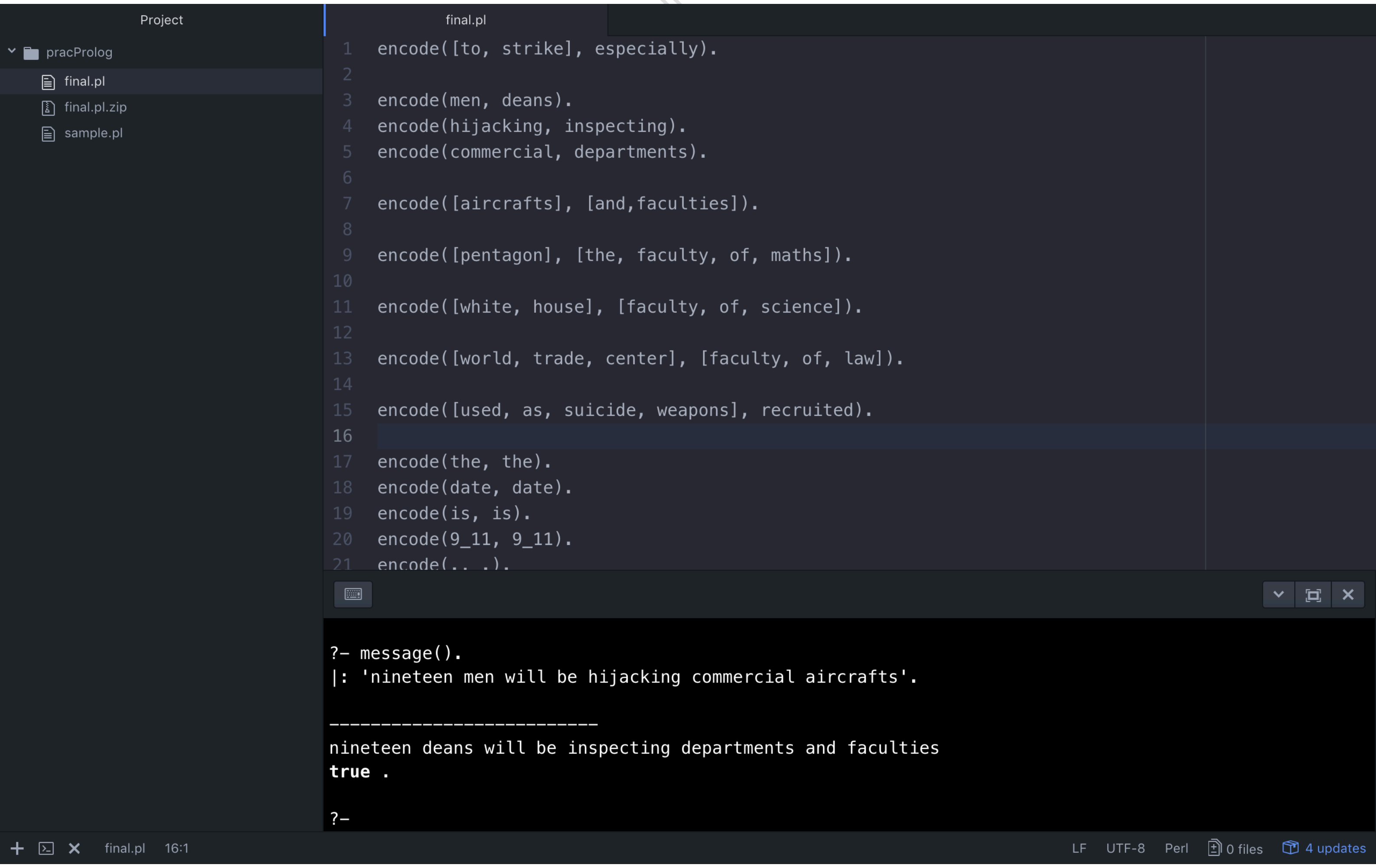
The screenshots are below, while the code is provided in a separate q1.pl file

Commands to type (after running swi-prolog) - [q1]. -> message().
Then type your message as - ‘ message ’.



```
encode([to, strike], especially).

encode(men, deans).
encode(hijacking, inspecting).
encode(commercial, departments).

encode([aircrafts], [and,faculties]).

encode([pentagon], [the, faculty, of, maths]).

encode([white, house], [faculty, of, science]).

encode([world, trade, center], [faculty, of, law]).
```

```
?- message().
|: 'nineteen men will be hijacking commercial aircrafts'.

--------------------------
nineteen deans will be inspecting departments and faculties
true .

?- message().
|: 'nineteen men will be used as suicide weapons . they will be hijacking several commercial aircraf
ts to strike the world trade center , pentagon and the white house'.

--------------------------
nineteen deans will be recruited . they will be inspecting several departments and faculties especia
lly the faculty of law , the faculty of maths and the [faculty,of,science]
true .

?-
```



```
encode([to, strike], especially).

encode(men, deans).
encode(hijacking, inspecting).
encode(commercial, departments).

encode([aircrafts], [and,faculties]).

encode([pentagon], [the, faculty, of, maths]).

encode([white, house], [faculty, of, science]).

encode([world, trade, center], [faculty, of, law]).

encode([used, as, suicide, weapons], recruited).

encode(the, the).
encode(date, date).
encode(is, is).
encode(9_11, 9_11).
encode(., .).
```

```
?- message().
|: 'nineteen men will be hijacking commercial aircrafts'.

--------------------------
nineteen deans will be inspecting departments and faculties
true .

?-
```

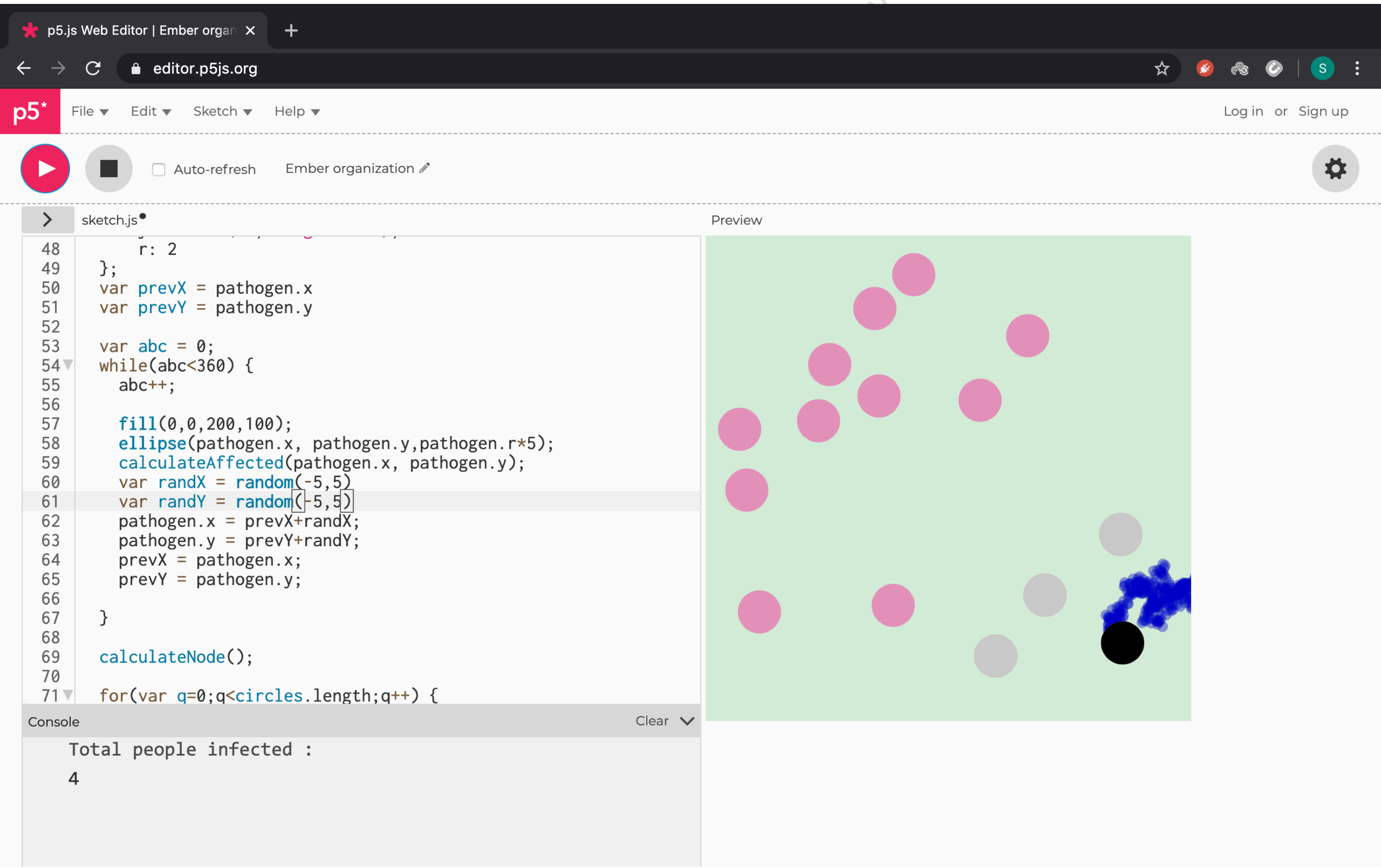
Q - 2 Epidemic Modelling

Ans - 2

For this question I tried to make a prolog program but failed. I could see where backtracking and recursion will be used (elaborated further), but after several hours, I was unable to make a working prolog program. I however was able to model some of the pathogen in javascript to study it's effects in Zones.

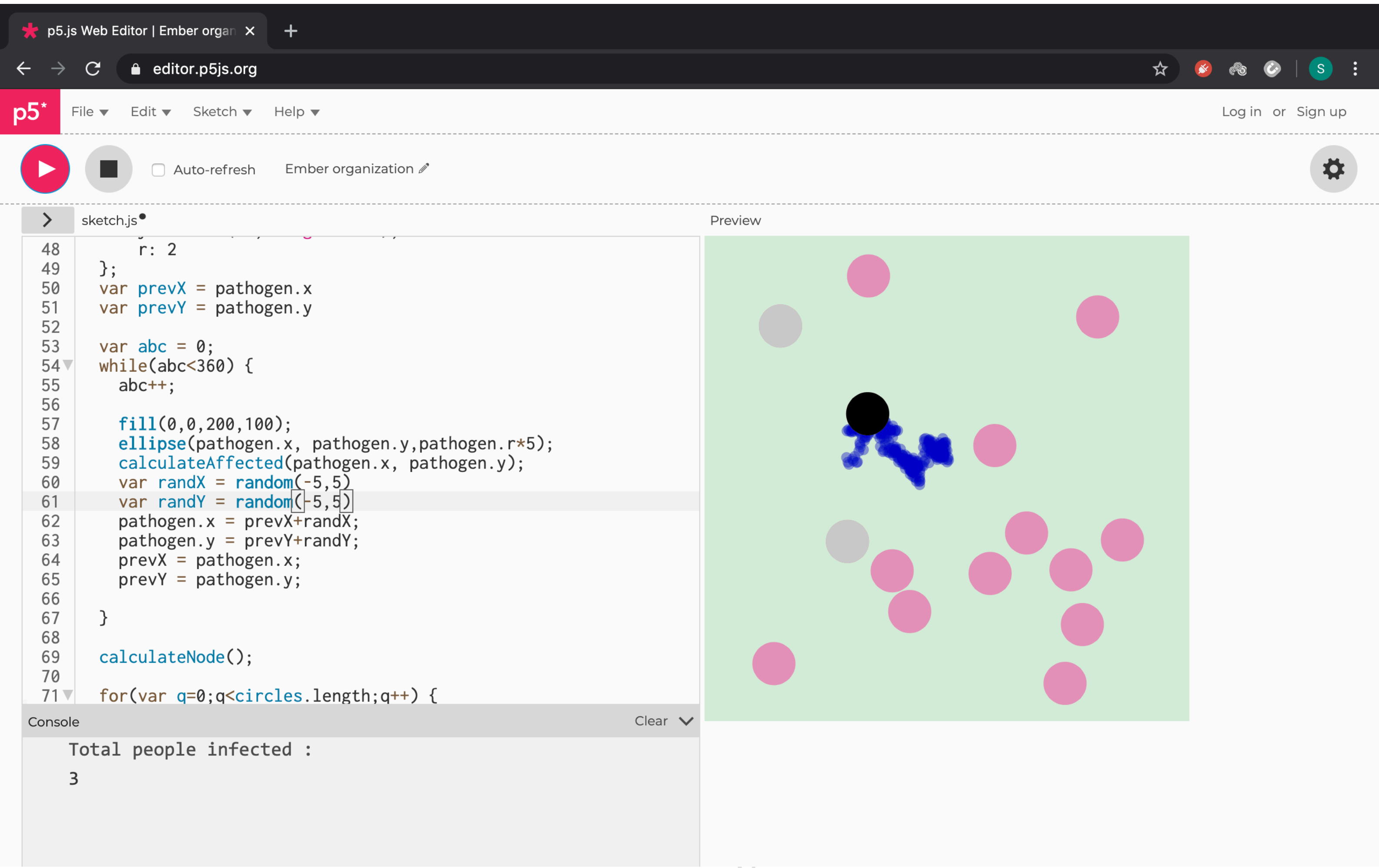
Taking One Zone at a time - We'll first take the example of the ECZ or extreme congestion zone. For the base case I assumed that the affected area had 100 people and each different type of zone existed once.

Pathogen - I have assumed that the pathogen travels 0.25 m/sec. Although the pathogen is initially present in a host(human), I here have assumed that the pathogen is independent when it is first born.



```
    r: 2
};
var prevX = pathogen.x
var prevY = pathogen.y

var abc = 0;
while(abc<360) {
  abc++;

  fill(0,0,200,100);
  ellipse(pathogen.x, pathogen.y,pathogen.r*5);
  calculateAffected(pathogen.x, pathogen.y);
  var randX = random(-5,5)
  var randY = random(-5,5)
  pathogen.x = prevX+randX;
  pathogen.y = prevY+randY;
  prevX = pathogen.x;
  prevY = pathogen.y;

}

calculateNode();

for(var q=0;q<circles.length;q++) {
```

```
Total people infected :
4
```



```
    r: 2
  };
  var prevX = pathogen.x
  var prevY = pathogen.y

  var abc = 0;
  while(abc<360) {
    abc++;

    fill(0,0,200,100);
    ellipse(pathogen.x, pathogen.y,pathogen.r*5);
    calculateAffected(pathogen.x, pathogen.y);
    var randX = random(-5,5)
    var randY = random(-5,5)
    pathogen.x = prevX+randX;
    pathogen.y = prevY+randY;
    prevX = pathogen.x;
    prevY = pathogen.y;

  }

  calculateNode();

  for(var q=0;q<circles.length;q++) {
```

```
Total people infected :
3
```

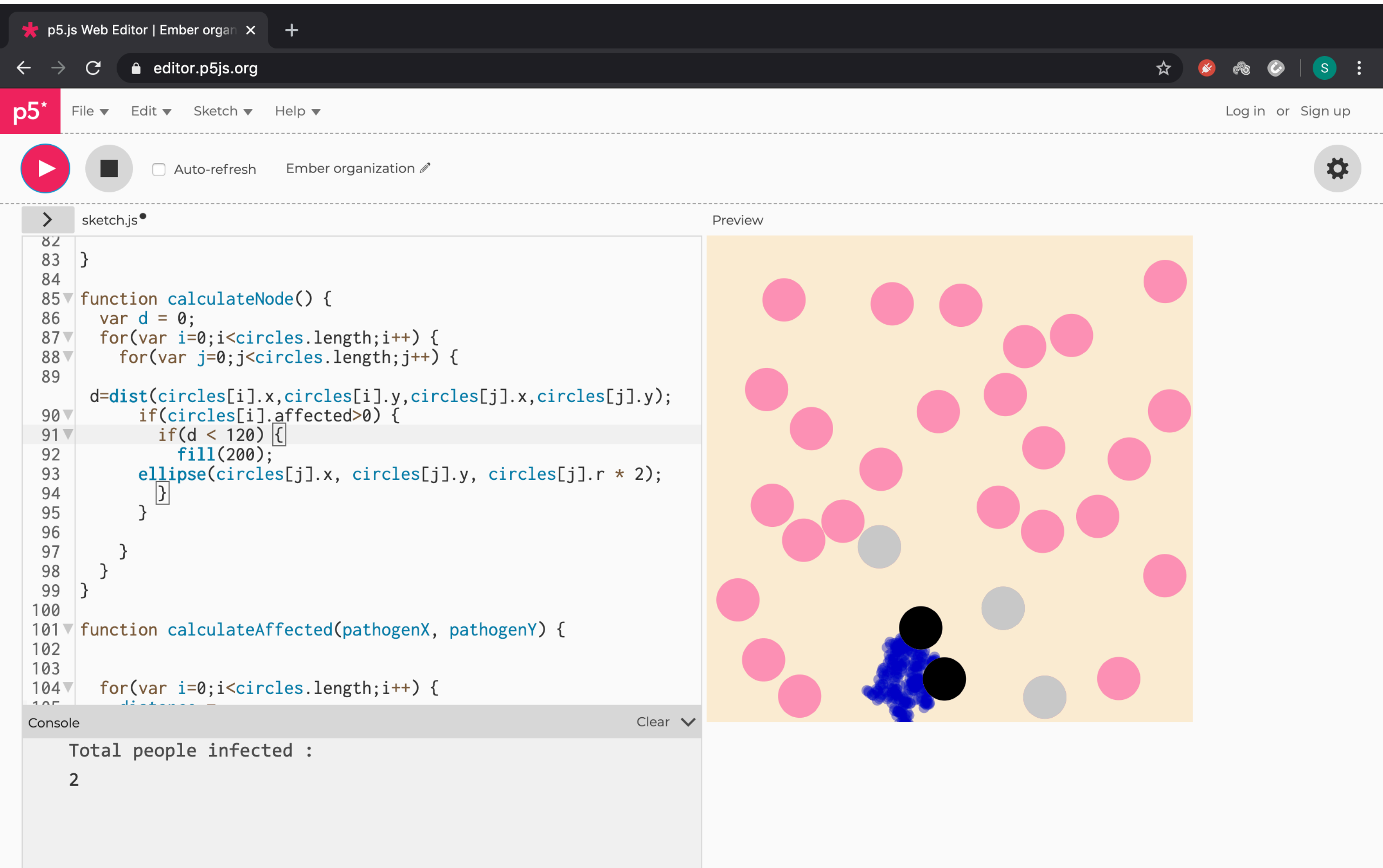
These are the pathogens movements for ECZ every five seconds.
They are cooler coded as -
Blue circles - The pathogen.
Black circles - The nodes affected by pathogens
Grey circles - The nodes affected by black circles (Other affected nodes)

(Note - this is the base case and other considerations of other cases are explained further)

HCZ - High congestion zones.

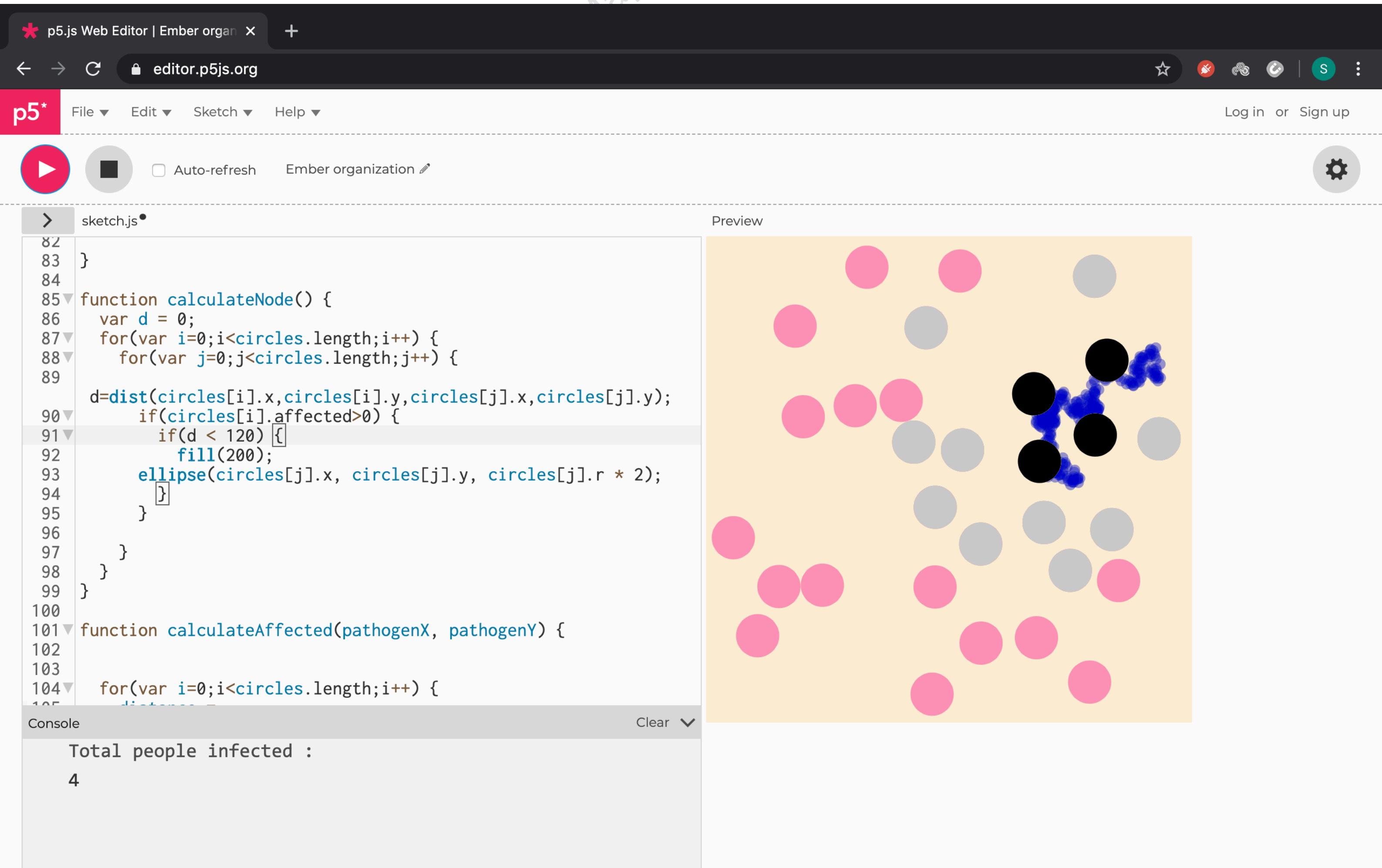
The path of the pathogen in High congestion zones is shown below -

(Here ,the code is modified a little to show only the people affected by the pathogen.)



```
}

function calculateNode() {
  var d = 0;
  for(var i=0;i<circles.length;i++) {
    for(var j=0;j<circles.length;j++) {

 d=dist(circles[i].x,circles[i].y,circles[j].x,circles[j].y);
      if(circles[i].affected>0) {
        if(d < 120) {
          fill(200);
      ellipse(circles[j].x, circles[j].y, circles[j].r * 2);
        }
      }

    }
  }
}

function calculateAffected(pathogenX, pathogenY) {


  for(var i=0;i<circles.length;i++) {
```

```
Total people infected :
2
```



```
}

function calculateNode() {
  var d = 0;
  for(var i=0;i<circles.length;i++) {
    for(var j=0;j<circles.length;j++) {

 d=dist(circles[i].x,circles[i].y,circles[j].x,circles[j].y);
      if(circles[i].affected>0) {
        if(d < 120) {
          fill(200);
      ellipse(circles[j].x, circles[j].y, circles[j].r * 2);
        }
      }

    }
  }
}

function calculateAffected(pathogenX, pathogenY) {


  for(var i=0;i<circles.length;i++) {
```

```
Total people infected :
4
```

Modelling process - I modelled them by the specifications given in the question. The width and height of these zones were chosen keeping in mind the average distances mentioned in the question. Also after coming in contact for just five seconds, the probability of 0.7 is also taken into consideration and is shown clearly in the code.

Assumptions - Although, if a person is affected ,he/she may spread the pathogen, which will affect other hosts.But however, here I assumed that if another person is in close contact (less than a certain number of meters, for certain zones), he/she will get affected.

First conclusion and analysis - I was able to conclude that for nodes present in High congestion zones (> 30 % of the whole population), the number of people affected was more, and it grew exponentially with respect to the congestion rate increasing.

(a) - I chose to model this pandemic from the pathogens perspective as ,here there were mainly two things to consider

1- What nodes are affected by the pathogen

2 - What nodes are affected by other nodes.

For modelling from PP ,we were not concerned with the healing/death rate of the nodes. We were merely concerned with affecting them and I though that was relatively easy to do.

(b) -

i - It is not guaranteed that x% of population will be affected. In much of my simulations, the pathogen stopped affecting nodes after some time. In my model however, inter-node percentage can easily be calculated. The variable totalInfected gives us the total number of nodes affected and n (used in the loop in the beginning) can be used to calculate the percentage.

ii - If MOP is

Static - There is a very good chance that only a few people will be infected, and the spread of the virus will stop.

Dynamic - As people move and come in close proximity to one another, the chances of them getting affected increase. Most of them could have been saved, had they not moved.

SN - If only the affected and sick stay at home, the results don't change radically f rom Dynamic.

(I was not able to create a program depicting what would happen if more than one zones exist ,how the nodes would interact with each other and how they would be affected.)

SHIVAM HARJAI
2017CSC1018