

LASTNAME	FIRSTNAME	SRN	(MARK)	(% OF FINAL MARK)	EXTRA MARKS
Aboo	Ahmed	19011398	40	42	2
Ahmed	Zoheb	19011874	40		

Copy and past your code in the yellow area below  
the code should occupy just one column (yellow) and no more than 100 lines (incl. spaces)

```
globals [radius cellsize-list]
patches-own [patch-state CellID]
turtles-own [cellsize]

to setup
  clear-all
  set radius 2
  create-turtles #cells [
    if mode = "Restricted" [
      set xcor #units set ycor #units
    ]
  ]
  ifelse mode = "Unrestricted" [
    setxy random-xcor random-ycor
  ]
  [
    let random-Y (- #units ) + random-float (2 * #units)
    let random-X (- #units ) + random-float (2 * #units)
    setxy random-X random-Y
  ]
]

ask patches with [pcolor = black] [
  set CellID -1
  if pcolor = black [set patch-state "X"]
]

ask turtles [
  set cellsize-list n-values #cells [0]
]

reset-ticks
end

to go
  set cellsize-list []
  expand-cells
  make-membrane
  tick
end

to expand-cells
  set radius radius + 1
  ask turtles [
    ask patches in-radius radius [
      build-up-cells
    ]
  ]
  ask turtles [
    let currentCellSize count patches with [CellID = [CellID] of myself]
    set cellsize currentCellSize
    set cellsize-list lput cellsize cellsize-list
  ]
end

to build-up-cells
  if pcolor = black or CellID = [who] of myself
  [
    set CellID ([who] of myself)
    set pcolor [color] of myself
  ]
end

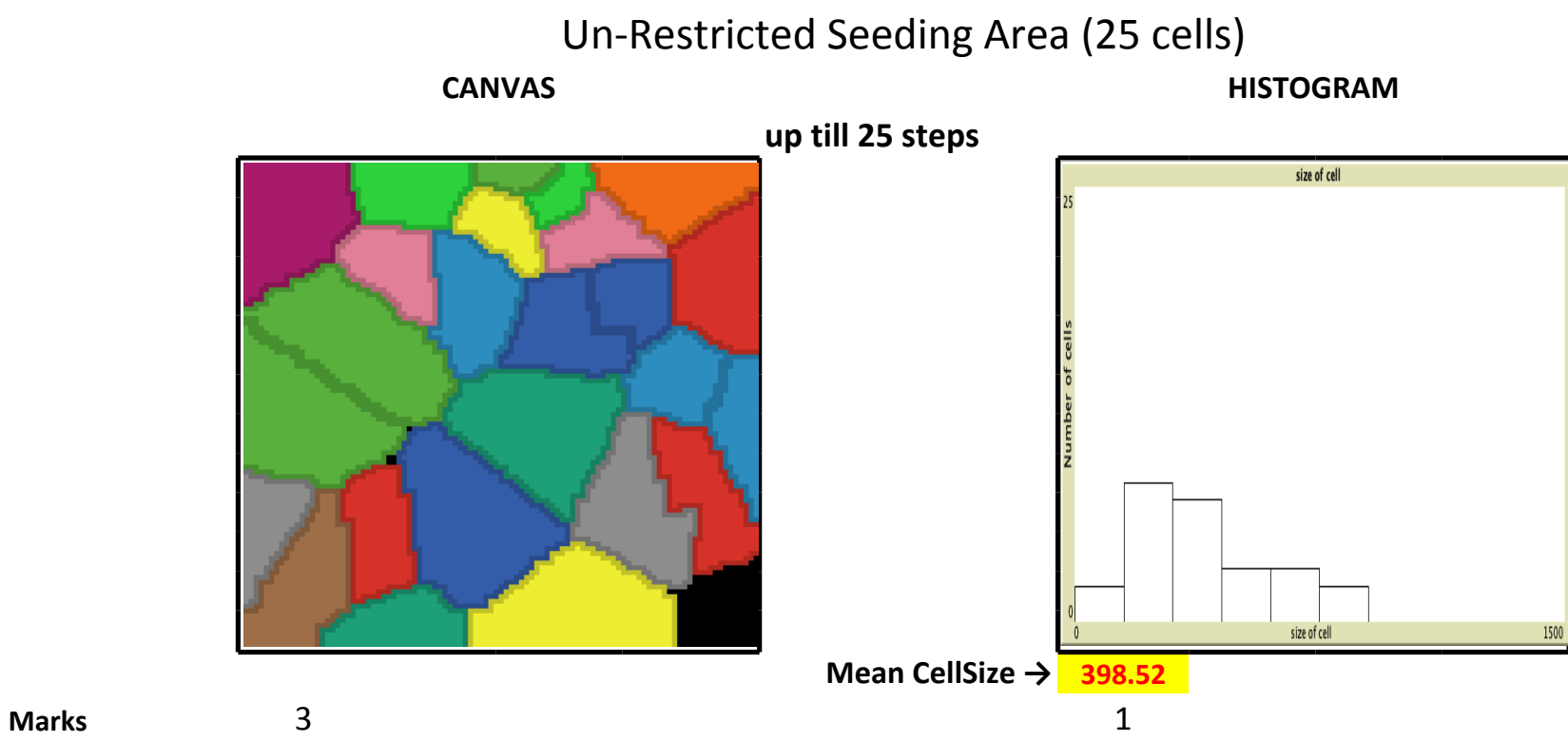
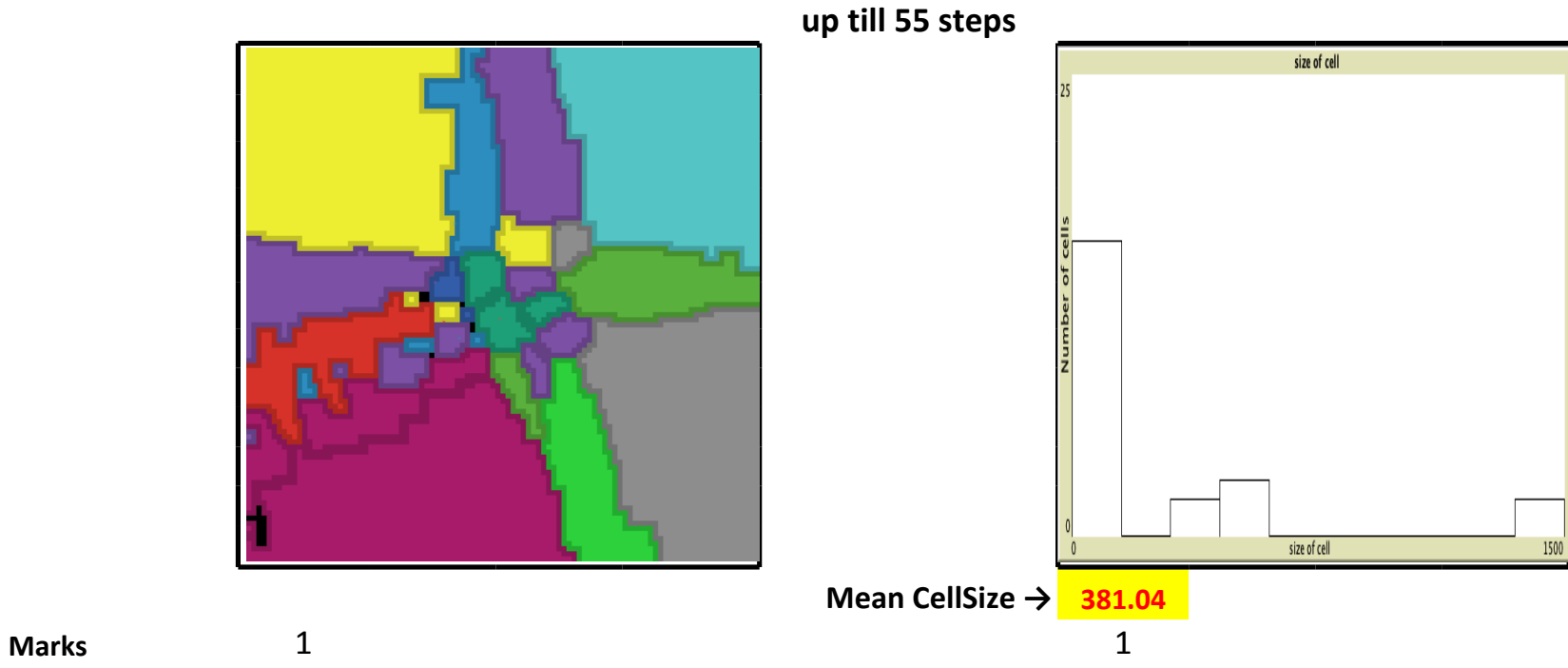
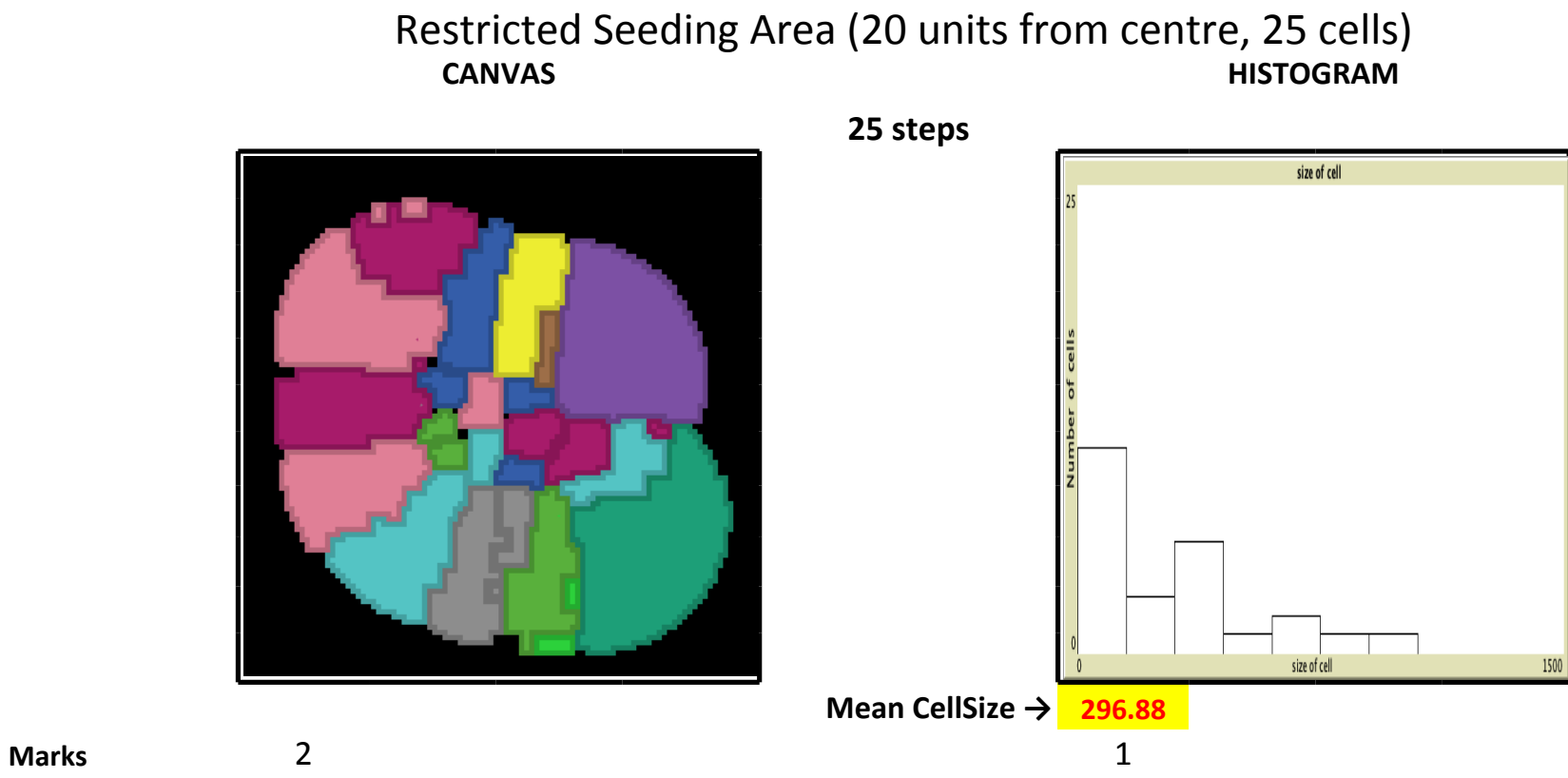
to make-membrane
  ask patches with [pcolor != black] [
    ifelse not any? neighbors with [CellID != [CellID] of myself] [
      set patch-state "I"
    ]
    [
      set patch-state "M"
      set pcolor pcolor - 1
    ]
  ]
end

trim
end

to trim
  ask patches with [patch-state = "M"] [
    if not any? neighbors with [ patch-state = "I" ]
    [
      set patch-state "X"
      set CellID CellID = 0
      set pcolor black
    ]
  ]
end
```

Screen Shots

(Click on the Canvas or the plot with Right HandMouse Button, choose "Copy View" and paste in the boxes below)



TOTAL MARKS FOR PLOTS

9

Questions

1 Do different classes of cells (with respect to their shape) develop during the growth process ? (Y/N)

a If No, why not?

(Write your answer in the textbox below)

b If Yes:

In what mode of the model? (R = Restricted/U = Unrestricted)

In the textbox below shorty describe the classes of cell shape and their position

In the Restricted mode the inner cells have barely any room to develop while in the Unrestricted mode more cells develop freely. So when unrestricted cells are positioned equally throughout the canvas they have more consistency in there shape and in restricted mode the inner cells grow irregularly and the outer cells spread out to the edge of the canvas.

Is there a direct specification in the code that tells which cells should take on what shape? (Y/N)

1b': If Yes, in what lines in your code ? (refer to row numbers of the copy of the code at the left)

1b'': if No, explain why and what you think what causes cell differentiation

(Write your answer in the textbox below)

2 How does the shape of the histogram relate to the shape of the cells as seen on the canvas?

(Write your answer in the textbox below)

They both show that the number of cells are spread out more evenly and individual cells grow larger when unrestricted.

and when Restricted the graph and canvas shows that more cells have different sizes because initially they all spawn in the center and they are more confined together,compared to the unristicted histogram and canvas.

3 Advanced Exercise. You can obtain two extra marks\* for the following task

Write a line of code for a sensible automatic stop condition in case of letting run the "to go" forever

if ticks = 55 [stop]

\*But your overall mark (for all the three course works of this module) will be capped at 100

TOTAL MARKS FOR ANSWERS  
plus bonus mark for extra exercise

MARKS

If correct 3 else 0

1a:  
up to 5 for good answer

(R/U)

U

1b:

if correct 0.5 else 0

up to 2 for good answer

(Y/N)

N

if correct

0.5 else 0

1b':

if correct

2

else 0

1b'':

up to 2 for good answer

up to 2 for good answer

2 for code that works

1a 10  
1b' 10  
1b'' 12

Program

	MARKS
BASIC SETUP	5
EXTENSIONS	
Step 1	a. Creating Restricted Mode 2
	b. Implementation of Chooser 1
	c. Settingthe radius to 2 1
	d. Set state of black patches to "X" 1
Step 2	Creation of correct "go" buttons 1
Step 3	Implementation of slider "#cells" 1
Step 4	Providing a Cell Identification number 1
	Dealing with who = CellID = 0 1
Step 5	Updating radius to let cells grow 1
Step 6	Avoiding cells overgrowing each other 1
Step 7	Providing cells with a membrane 1
Step 8	Implementation of trim procedure 1
Step 9	Histogram of cell size 1
	Monitor with computation of mean cellsize 1

TOTAL MARKS FOR PROGRAM  
Mark for copy of code

20  
1