Program Code – Agent Model

1. Turtle Procedures

```
breeds [A B]
turtles-own [birthprob deathprob]
globals [time]
globals [test]
to setup-pop
        if (breed = A)
        [setbirthprob 30
        setdeathprob 20
        setshape turtle-shape
        setc blue
        seth 0
        setxy round(random screen-width) round(random screen-height)
        if (count-turtles-here > 1)
                [findplace]
        ]

        if (breed = B)
        [setbirthprob 30
        setdeathprob 20
        setshape square-shape
        setc green
        seth 0
        setxy round(random screen-width) round(random screen-height)
        if (count-turtles-here > 1)
                [findplace]
        ]
end


to findplace
        loop
                [rt 90 jump round(random 50) lt 180
                if (count-turtles-here = 1)
                        [stop]
                ]
end


to reproduce
        ifelse (count-turtles-at 1 0) = 0
                [birth (xcor + 1) ycor]
                [ifelse (count-turtles-at -1 0) = 0
                        [birth (xcor - 1) ycor]
                        [ifelse (count-turtles-at 1 1) = 0
                                [birth (xcor + 1) (ycor + 1)]
                                [ifelse (count-turtles-at -1 1) = 0
                                        [birth (xcor - 1) (ycor + 1)]
                                        [ifelse (count-turtles-at 1 -1) = 0
                                                [birth (xcor + 1) (ycor - 1)]
```

```
                                    [ifelse (count-turtles-at -1 -1) = 0
                                        [birth (xcor - 1) (ycor - 1)]
                                        [ifelse (count-turtles-at 0 1) = 0
                                            [birth xcor (ycor + 1)]
                                            [if (count-turtles-at 0 -1) = 0
                                                [birth xcor (ycor - 1)]
                                            ]
                                        ]
                                    ]
                                ]
                            ]
                        ]
                    ]
end

to death
        if (random 100) < deathprob
                [die]
end

to walk
        if (count-turtles-here > 1)
                [findplace]
end

to birth :x :y
        if (breed = A)
                [if (random 100) < birthprob
                        [hatch [setxy :x :y]]
                ]
        if (breed = B)
                [if (random 100) < birthprob
                        [hatch
                                [setxy :x :y
                                let [:mutant (random 1000)]
                                if :mutant >= (PerfectRepro * 10)
                                        [ifelse :mutant < ((PerfectRepro * 10) + ((Deterioration /
100) * (1000 - (PerfectRepro * 10))))
                                                [ifelse (random 100) < 50
                                                        [setbirthprob (birthprob - (birthprob *
(Mutationfactor / 100)))

                                                        setc (color - 10)
                                                        if birthprob <= 5
                                                                [setbirthprob 5]
                                                        ]
                                                        [setdeathprob (deathprob + (deathprob *
(Mutationfactor / 100)))

                                                        setc (color - 10)
                                                        if deathprob > 95
                                                                [setdeathprob 95]
                                                        ]
```

```
                                                          ]
                                                          [ifelse (random 100) < 50
                                                                  [setbirthprob (birthprob + (birthprob *

(Mutationfactor / 100)))
                                                                  setc (color + 10)
                                                                  if birthprob > 95
                                                                          [setbirthprob 95]
                                                                  ]
                                                          [setdeathprob (deathprob - (deathprob *

(Mutationfactor / 100)))
                                                                  setc (color + 10)
                                                                  if deathprob <= 5
                                                                          [setdeathprob 5]
                                                                  ]
                                                          ]
                                                    ]
                                               ]
                                          ]
                                     ]
end
```

2. Observer Procedures

```
to setup
        clearplot
        ct
        ask-patches [setpc 8]
      settime 0
        create-A 50
        create-B 50
        ask-turtles [setup-pop]
        setup-graph
end

to setup-graph
        plotid 4
        pp 1 ppreset setppc blue  ppd ;A
        pp 2 ppreset setppc green ppd ;B
        setplot-xrange 0 200
        setplot-yrange 0 2000
        setplot-title "A versus B"
end

to graph
        pp 1 plotxy time count-A
        pp 2 plotxy time count-B
end

to live
        ask-turtles [reproduce]
```

```
        ask-turtles [death]
        ask-turtles [walk]
    settime (time + 1)
        plotid 4
        graph
        if (time = 200)
                [stop]
        live
end
```

3. StarLogo Window