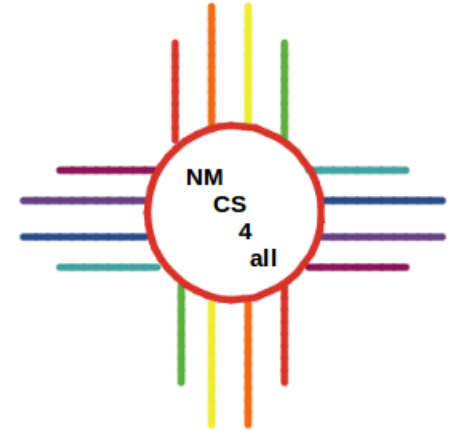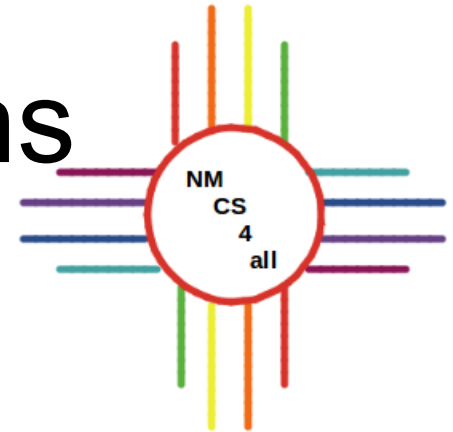# Module 4

Boolean Logic

Overview

- Booleans
- Conditional statements
- Patches
- Agent-environment interactions

Booleans

- Can have one of two values:
    - true or false
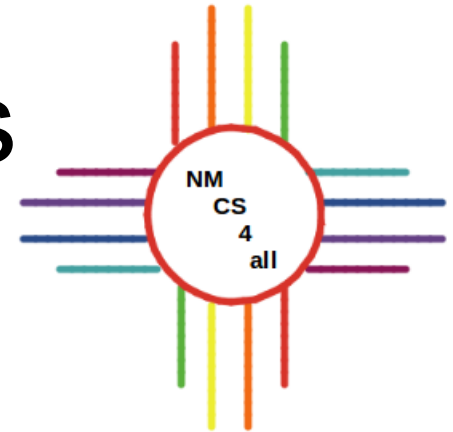   - on or off
    - 1 or 0

Boolean Expressions

- Evaluate to **true** or **false**
- Use comparison operators: =, <, >, <=, >=

$$3 + 4 > 3 + 3 \qquad \textbf{true}$$

$$4 = 4 \qquad \textbf{true}$$

$$3 < 3 \qquad \textbf{false}$$

$$3 + 4 >= 7 \qquad \textbf{true}$$

Boolean Operators

- AND, OR, NOT
- Combine Boolean expressions
- Evaluate to a Boolean
- Order of operation:

    1. Parentheses
    2. NOT
    3. AND
    4. OR

Boolean Operators: OR

A	B	A OR B
true	true	true
true	false	true
false	true	true
false	false	false

Boolean Operators: AND

A	B	A AND B
true	true	true
true	false	false
false	true	false
false	false	false

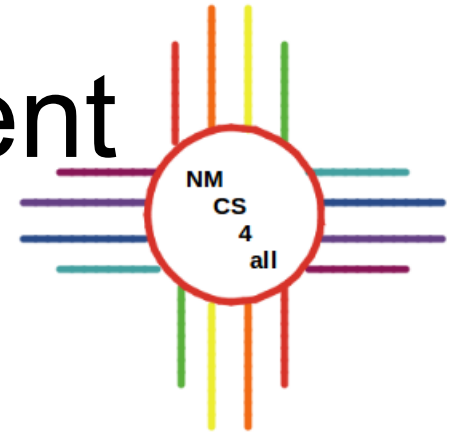# Boolean Operators: NOT

A	NOT A
true	false
false	true

Conditional Statement

- If a condition is true, execute a statement
- Otherwise, do not execute it
- Maybe execute another statement
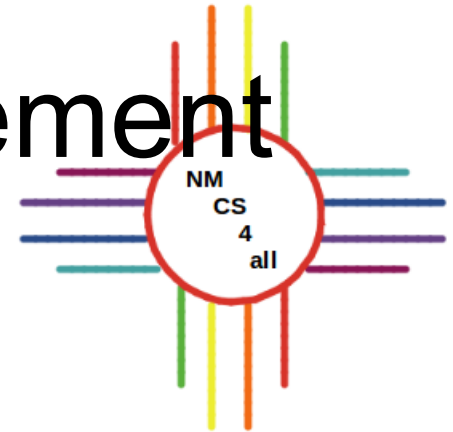
NetLogo `if` Statement

if *condition*
[
    commands
]

```
if (patch_ahead_color = green)
[
  forward 1
]
```

Netlogo `if-else` Statement

ifelse *condition*

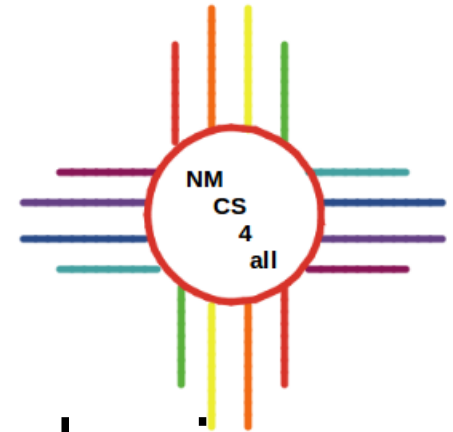[

    commands

]

[

    commands

]

```
ifelse (patch_ahead_color = black)
[
    right random 180
]
[
    forward 1
]
```

Interactions

- The environment can change turtle behavior
- Two types of interaction:
  - - Between turtles
  - - Between turtles and patches

  - - Both are an important part of agent based modeling

Patches

- - The world is a grid of patches
- - Patches can be given instructions

- ```
  ask patches [set pcolor green]
  ```

- - Patches can be identified uniquely

- ```
  ask patch 1 1 [set pcolor green]
  ```

- - The origin's coordinates are 0 0
- - The world can wrap horizontally and vertically

Turtle/Patch Interactions

- - There are many possible interactions
- - There is usually a trigger
- - Examples of possible triggers:
    - - Patch color
    - - Patch location
    - - Patch occupant

Turtle/Patch Interactions

- - There is usually a response
  - - Change something about the turtle
    - Shape, color, size, direction etc
  - - Change something about the patch
    - Color etc
  - - Other responses are possible

Initial World
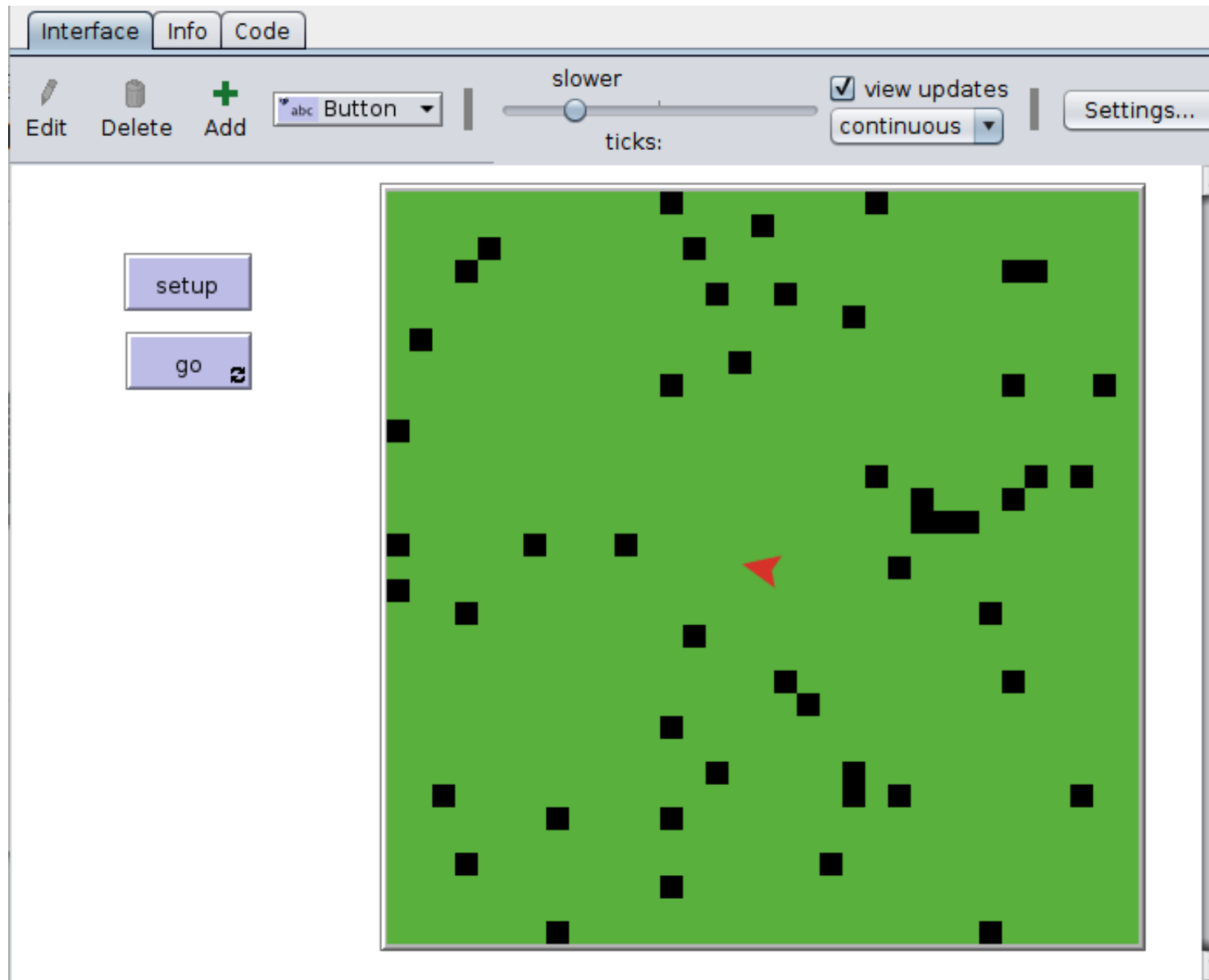
Setup

```
to setup
  clear-all
  create-turtles 1
  [
    set color red
    set size 2
  ]
  ask patches
  [ set pcolor green ]
  ask n-of 50 patches
  [ set pcolor black ]
end
```
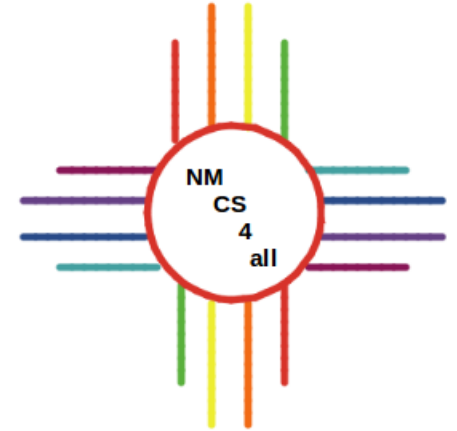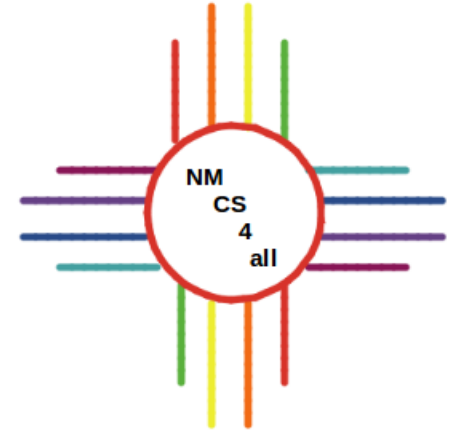
Go

```
to go
  let patch_ahead_color green
  ask turtles
  [

    pen-down
    ask patch-ahead 1 [
    set patch_ahead_color pcolor
    ]
    ifelse (patch_ahead_color = black)
    [ right random 180 ]
    [ forward 1 ]

  ]
end
```

NM
CS
4
all

Result

Thank you for watching!

Slides created by Bianca Bologa

https://moseslab.cs.unm.edu/lab-page/bianca-bologa.html

Video recorded by Antonio Griego

https://moseslab.cs.unm.edu/lab-page/antonio-griego.html