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: =, <, >, <=, >=

\[
\begin{align*}
3 + 4 &> 3 + 3 & \text{true} \\
4 & = 4 & \text{true} \\
3 & < 3 & \text{false} \\
3 + 4 & \geq 7 & \text{true}
\end{align*}
\]
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

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>A OR B</th>
</tr>
</thead>
<tbody>
<tr>
<td>true</td>
<td>true</td>
<td>true</td>
</tr>
<tr>
<td>true</td>
<td>false</td>
<td>true</td>
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<tr>
<td>false</td>
<td>true</td>
<td>true</td>
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<tr>
<td>false</td>
<td>false</td>
<td>false</td>
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</tbody>
</table>
### Boolean Operators: AND

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>A AND B</th>
</tr>
</thead>
<tbody>
<tr>
<td>true</td>
<td>true</td>
<td>true</td>
</tr>
<tr>
<td>true</td>
<td>false</td>
<td>false</td>
</tr>
<tr>
<td>false</td>
<td>true</td>
<td>false</td>
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<tr>
<td>false</td>
<td>false</td>
<td>false</td>
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</tbody>
</table>
### Boolean Operators: NOT

<table>
<thead>
<tr>
<th>A</th>
<th>NOT A</th>
</tr>
</thead>
<tbody>
<tr>
<td>true</td>
<td>false</td>
</tr>
<tr>
<td>false</td>
<td>true</td>
</tr>
</tbody>
</table>
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
]
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
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
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
Result
Thank you for watching!
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Video recorded by Antonio Griego
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