Game of Life
Toggling a Cell
Lecture 14

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Outline

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User Interface

- The user will toggle the state of a cell by clicking on that cell.
- The program must
  - Detect the mouse-click.
  - Convert window coordinates to world coordinates.
  - Determine the row and column number of the cell.
  - Reverse the state of the cell.

Outline

Detecting the Mouse-Click

MouseButton Callback Function

```
void mouseButtonCB(GLFWwindow* window,
    GLint button, GLint action, GLint mods);
```

- When the mouse is clicked in the graphics window, the mouse button callback function in invoked.
- The parameter `button` is one of
  - `GLFW_MOUSE_BUTTON_LEFT`
  - `GLFW_MOUSE_BUTTON_RIGHT`
- The parameter `action` is one of
  - `GLFW_PRESS`
  - `GLFW_RELEASE`

Locating the Mouse-Click

`glfwGetCursorPos()` Function

```
void glfwGetCursorPos(GLFWwindow* window,
    GLdouble* xpos, GLdouble* ypos)
```

- The `glfwGetCursorPos()` function will return the window coordinates of the cursor.
- The *x*-coordinate `xpos` is measured from the left edge of the window.
- The *y*-coordinate `ypos` is measured *down* from the top edge of the window.
- It is recommended that you subtract `ypos` from the window height.

Related Functions

CursorPos Callback Function

```
void cursorPosCB(GLFWwindow* window,
    GLdouble xpos, GLdouble ypos)
```

`glfwGetMouseButton()` Function

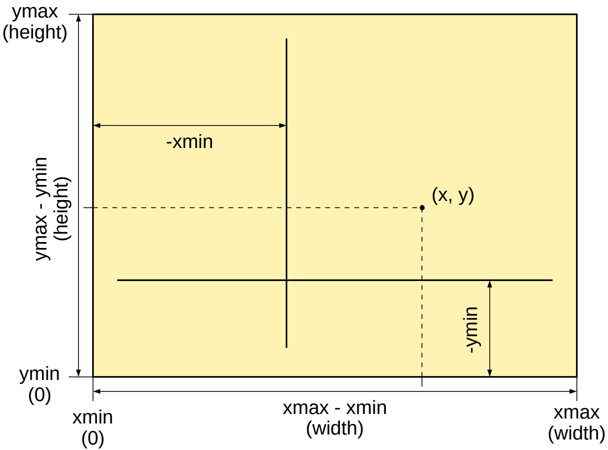
```
int glfwGetMouseButton(GLFWwindow* window,
    GLint button);
```

- These functions are useful for processing dragging objects (moving the cursor with the mouse button down).

Outline

Converting to World Coordinates

- In window coordinates, the *x*-axis goes from `0` to `fb_width` and the *y*-axis goes from `0` to `fb_height`.
- In world coordinates, the *x*-axis goes from `xmin` to `xmax` and the *y*-axis goes from `ymin` to ymax.
- In the Game of Life program, $\texttt{xmin} = -\texttt{xmax}$ and $\texttt{ymin} = -\texttt{ymax}$.


ymax
(height)
-xmin
(x, y)
ymax - ymin
(height)
-ymin
ymin
(0)
xmin
(0)
xmax - xmin
(width)
xmax
(width)

- First, scale the coordinates from units in the window system to units in the world system.

$$x_{wor} = x_{win} \times \left(\frac{xmax - xmin}{width} \right),$$
$$y_{wor} = y_{win} \times \left(\frac{ymax - ymin}{height} \right).$$

- Then, apply a translation as an offset from the lower-left corner (in world coordinates) to align the respective origins.

$$x_{wor} = xmin + x_{win} \times \left(\frac{xmax - xmin}{width} \right),$$
$$y_{wor} = ymin + y_{win} \times \left(\frac{ymax - ymin}{height} \right).$$