# CS 134:

# Tic Tac Toe (3)

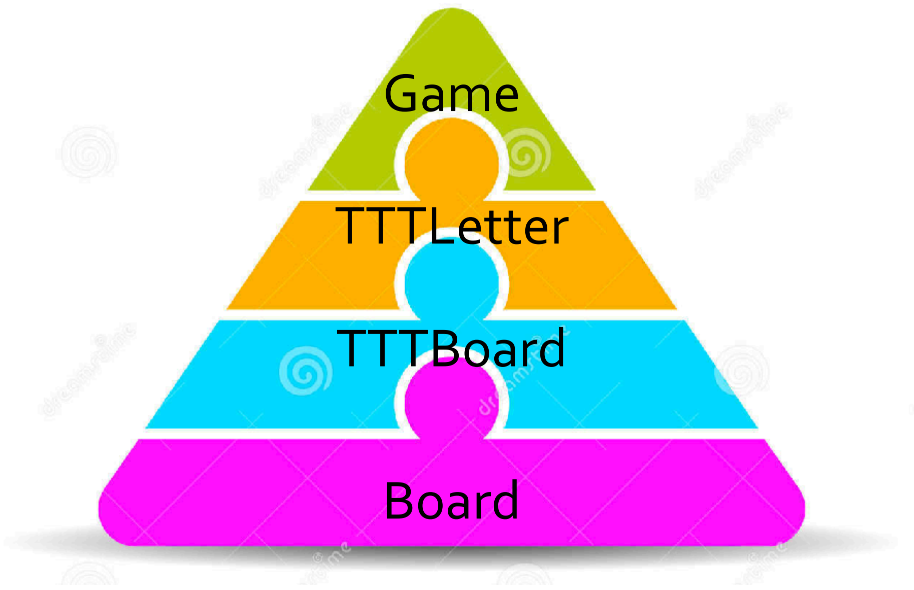
# Announcements & Logistics

- **Lab 7** feedback coming soon
- **HW 8** due Monday @ 11 pm
- **Lab 9 Boggle** released today: multi-week partners lab (counts as a two labs in terms of grade; Lab is decomposed into **three** logical parts
  - **Parts 1 & 2 (BoggleLetter & BoggleBoard)** due Wed/Thur 11 pm
  - We will run our tests on these and return automated feedback (similar to Lab 4 part 1), but you are allowed to revise it afterwards
  - **Parts 3 (BoggleGame)** due the following week
  - Please spend time planning and thinking about design before your lab session!
- TA apps due today: https://csci.williams.edu/tatutor-application/

**Do You Have Any Questions?**

# Last Time

- (Briefly) Looked at important helper methods in the **`Board`** class
- Discussed how to build the **`TTTBoard`** class
    - Added a grid of **`TTTLetters`** to the **`Board`** class
    - Discussed logic to check for win on **`TTTBoard`**
    - Any questions?

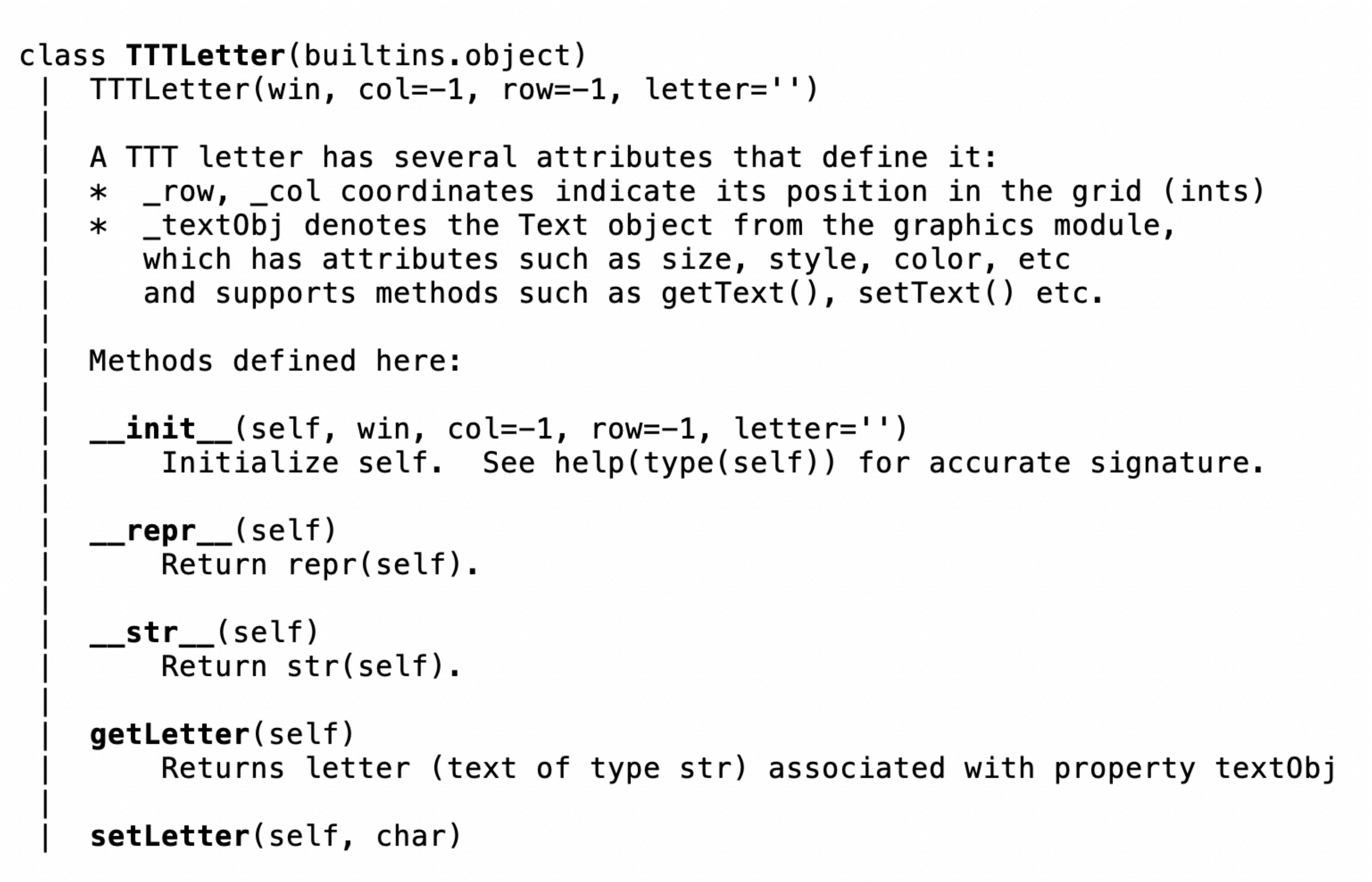


# Today's Plan

- Finish our game!  Woohoo!
- Implement TTTLetter
    - We already have a good sense of what it should do after our last class, but let's look at the details
- Implement the game logic
    - Keep track of mouse clicks
    - Keep track of players ("X" and "O" alternate)
    - Use methods in `TTTLetter` and `TTTBoard` to check for win after each move

# TTT Letters

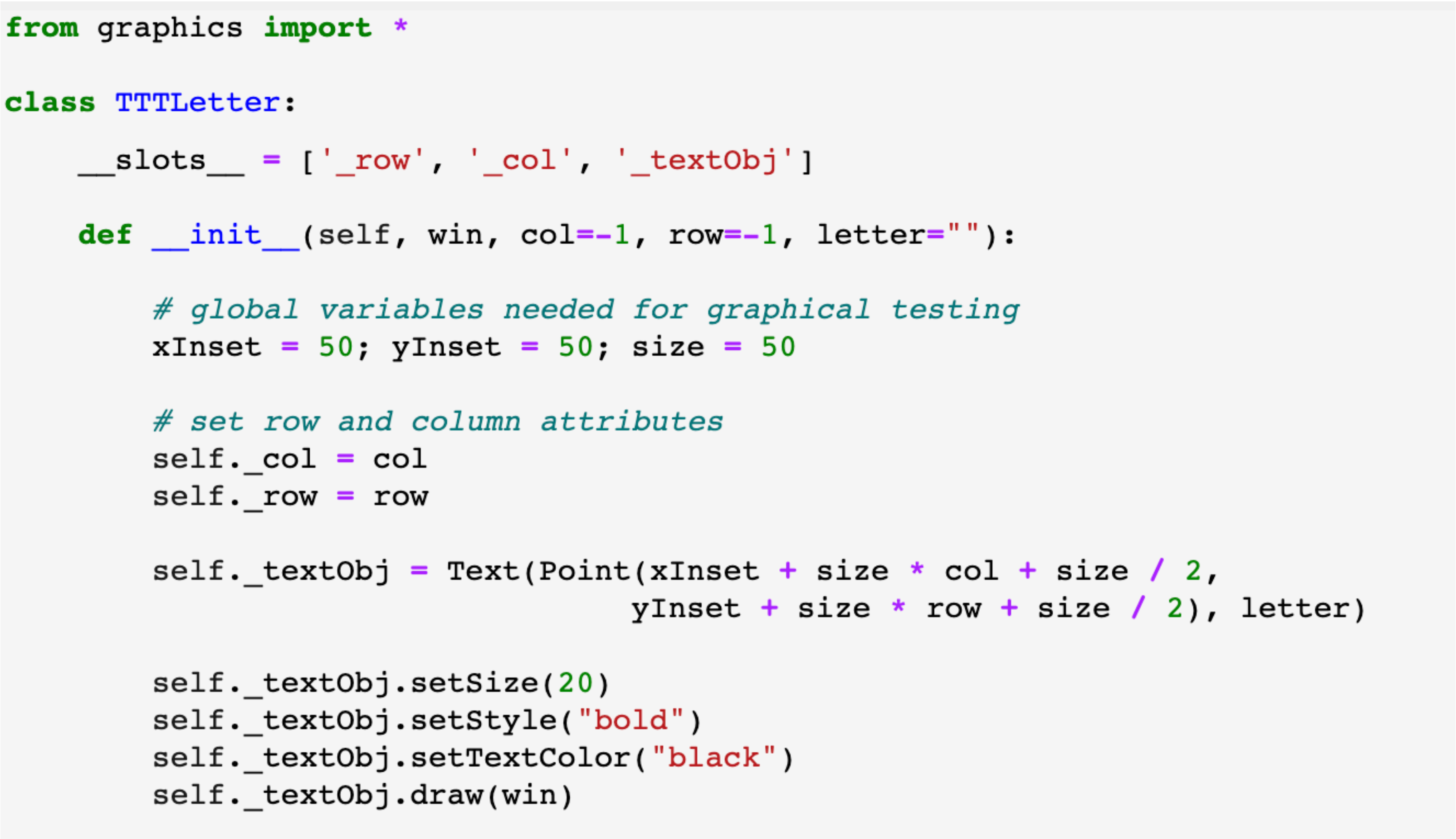
- We have already seen a glimpse of what TTTLetters needs to do
- In fact it has to support this functionality for TTTBoard!



```
class TTTLetter(builtins.object)
 |  TTTLetter(win, col=-1, row=-1, letter='')
 |
 |  A TTT letter has several attributes that define it:
 |  *  _row, _col coordinates indicate its position in the grid (ints)
 |  *  _textObj denotes the Text object from the graphics module,
 |     which has attributes such as size, style, color, etc
 |     and supports methods such as getText(), setText() etc.
 |
 |  Methods defined here:
 |
 |  __init__(self, win, col=-1, row=-1, letter='')
 |      Initialize self.  See help(type(self)) for accurate signature.
 |
 |  __repr__(self)
 |      Return repr(self).
 |
 |  __str__(self)
 |      Return str(self).
 |
 |  getLetter(self)
 |      Returns letter (text of type str) associated with property textObj
 |
 |  setLetter(self, char)
```

# TTTLetter: __init__

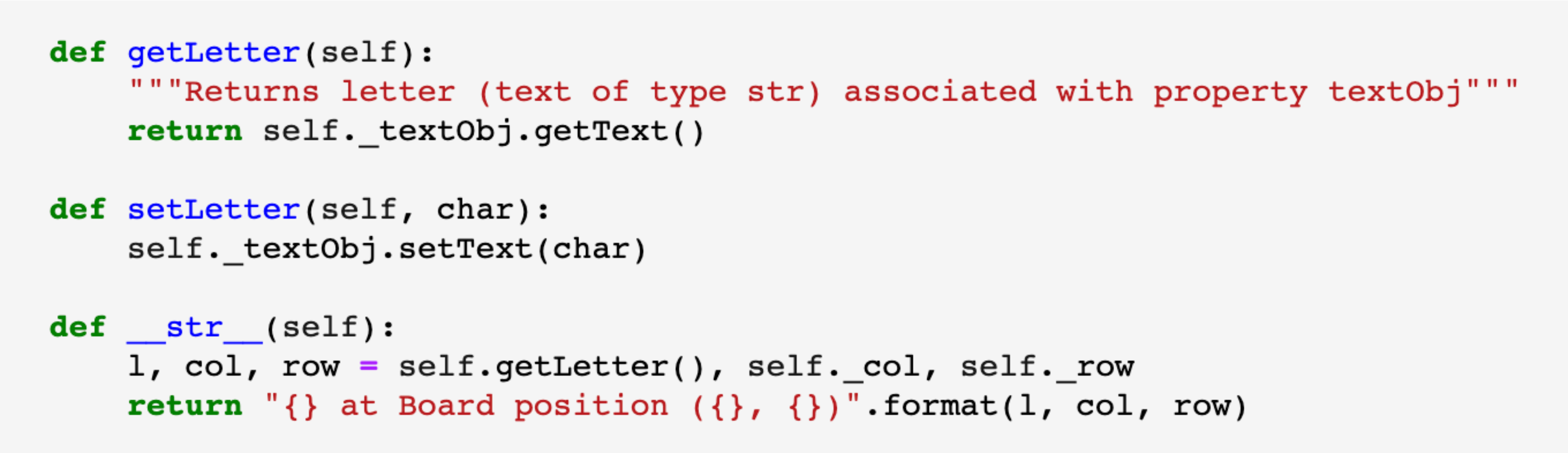
- Let's think about **`__init__`** first
  - A **`TTTLetter`** is just a "wrapper" around a **`Text`** object
  - Using passed in parameters (col, row, letter), initialize __slots__ attributes



```
from graphics import *

class TTTLetter:

    __slots__ = ['_row', '_col', '_textObj']

    def __init__(self, win, col=-1, row=-1, letter=""):

        # global variables needed for graphical testing
        xInset = 50; yInset = 50; size = 50

        # set row and column attributes
        self._col = col
        self._row = row

        self._textObj = Text(Point(xInset + size * col + size / 2,
                                   yInset + size * row + size / 2), letter)

        self._textObj.setSize(20)
        self._textObj.setStyle("bold")
        self._textObj.setTextColor("black")
        self._textObj.draw(win)
```

# TTTLetter: Getters, Setters, __str__

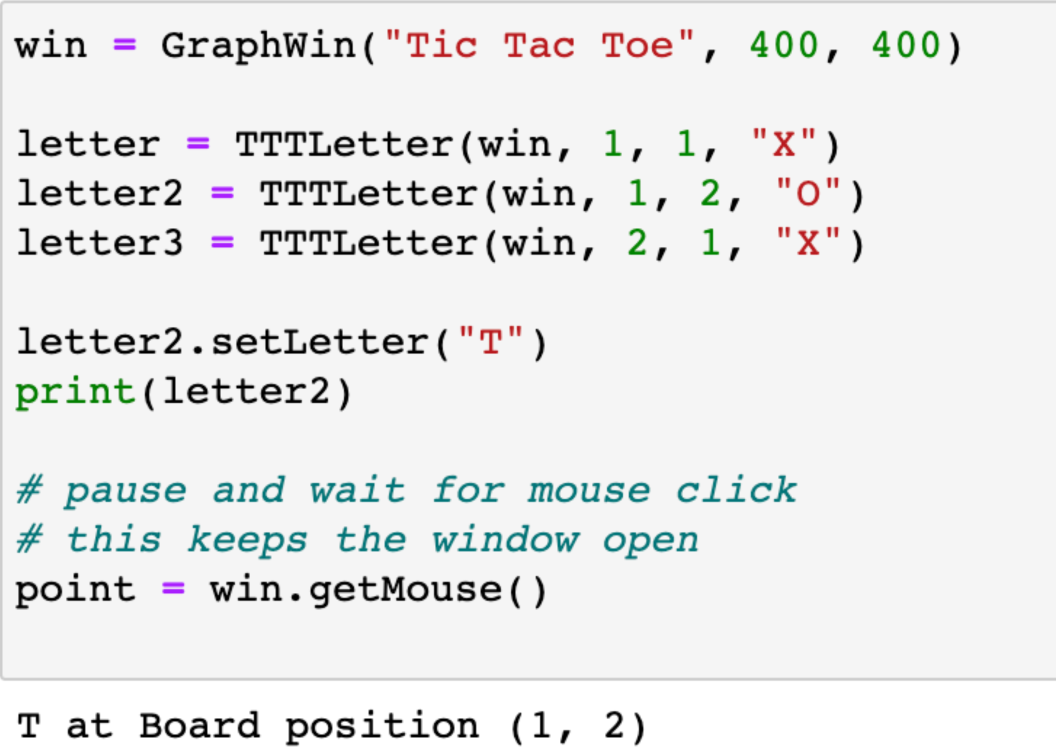
- Now let's implement the necessary getter/setter methods
  - We don't need/want to expose the Text object
  - We don't want to allow the row, col to be changed
  - We only expose the string (letter) of the Text object, so they are the only getter/setter methods we need
  - __str__ useful for debugging and testing



```
def getLetter(self):
    """Returns letter (text of type str) associated with property textObj"""
    return self._textObj.getText()

def setLetter(self, char):
    self._textObj.setText(char)

def __str__(self):
    l, col, row = self.getLetter(), self._col, self._row
    return "{} at Board position ({}, {})".format(l, col, row)
```

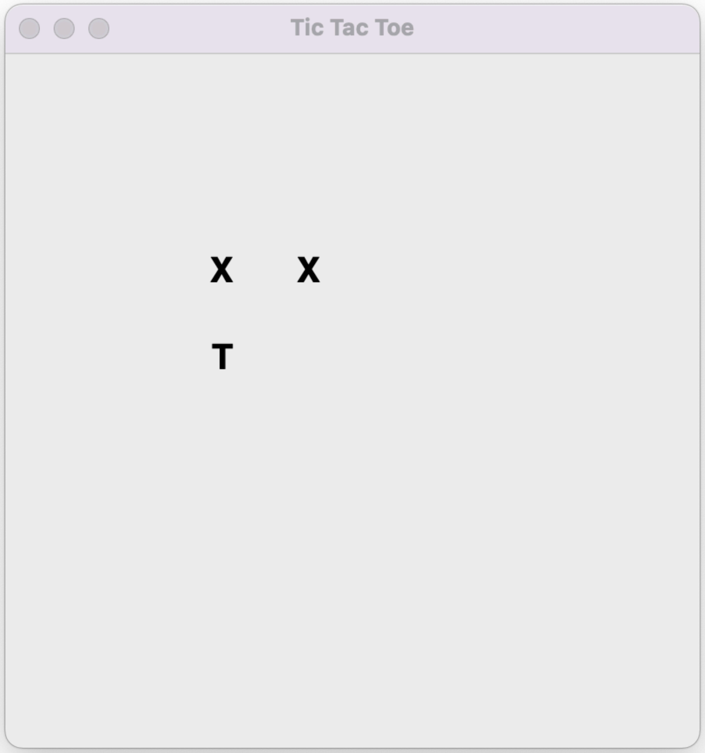
# Testing TTTLetter

- It's always a good idea to test our class and methods in isolation
- Note: No board involved!



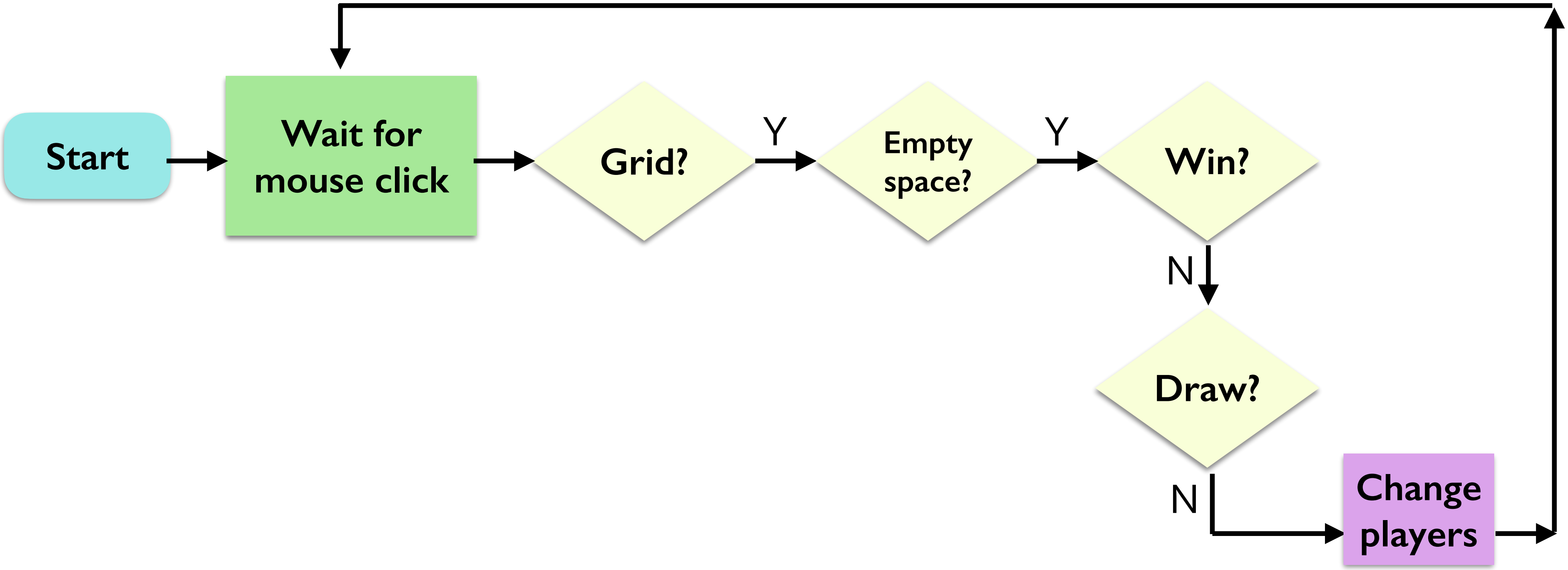
```
win = GraphWin("Tic Tac Toe", 400, 400)

letter = TTTLetter(win, 1, 1, "X")
letter2 = TTTLetter(win, 1, 2, "O")
letter3 = TTTLetter(win, 2, 1, "X")

letter2.setLetter("T")
print(letter2)

# pause and wait for mouse click
# this keeps the window open
point = win.getMouse()
```

```
T at Board position (1, 2)
```



# Finally…TTT Game Logic

- Let's create a TTT flowchart to help us think through the state of the game at various stages



Let's think about the "common" case: a valid move in the middle of the game

# Finally…TTT Game Logic

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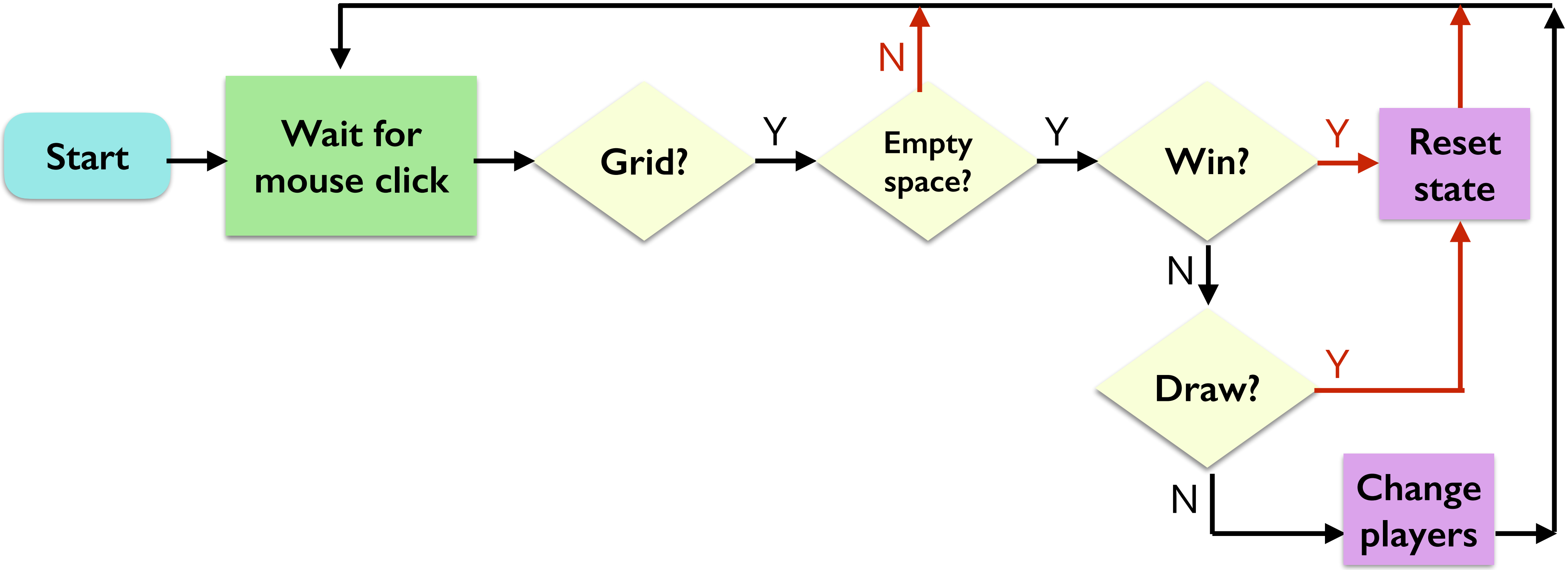
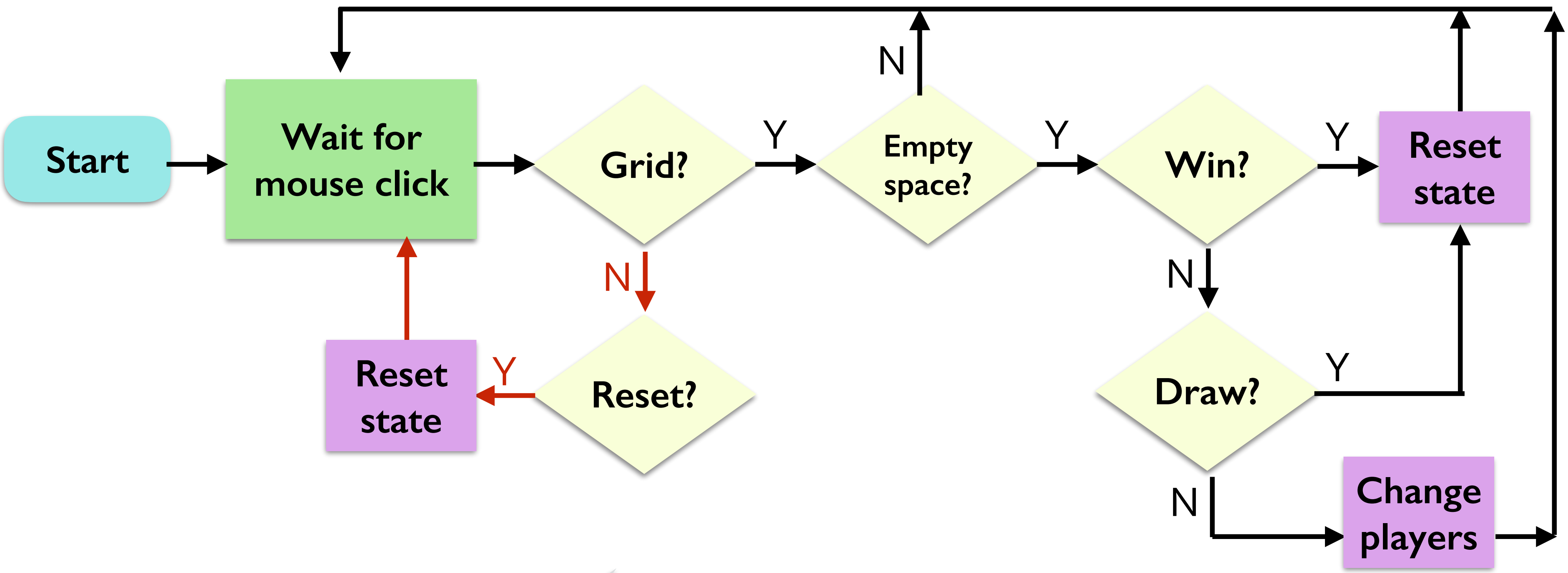
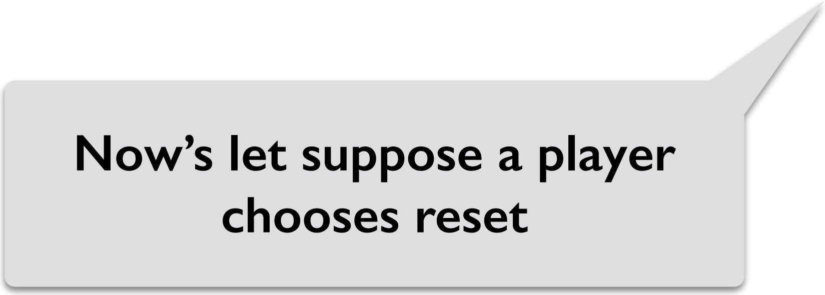


Now let's consider the case of a win, draw, or invalid move

# Finally…TTT Game Logic

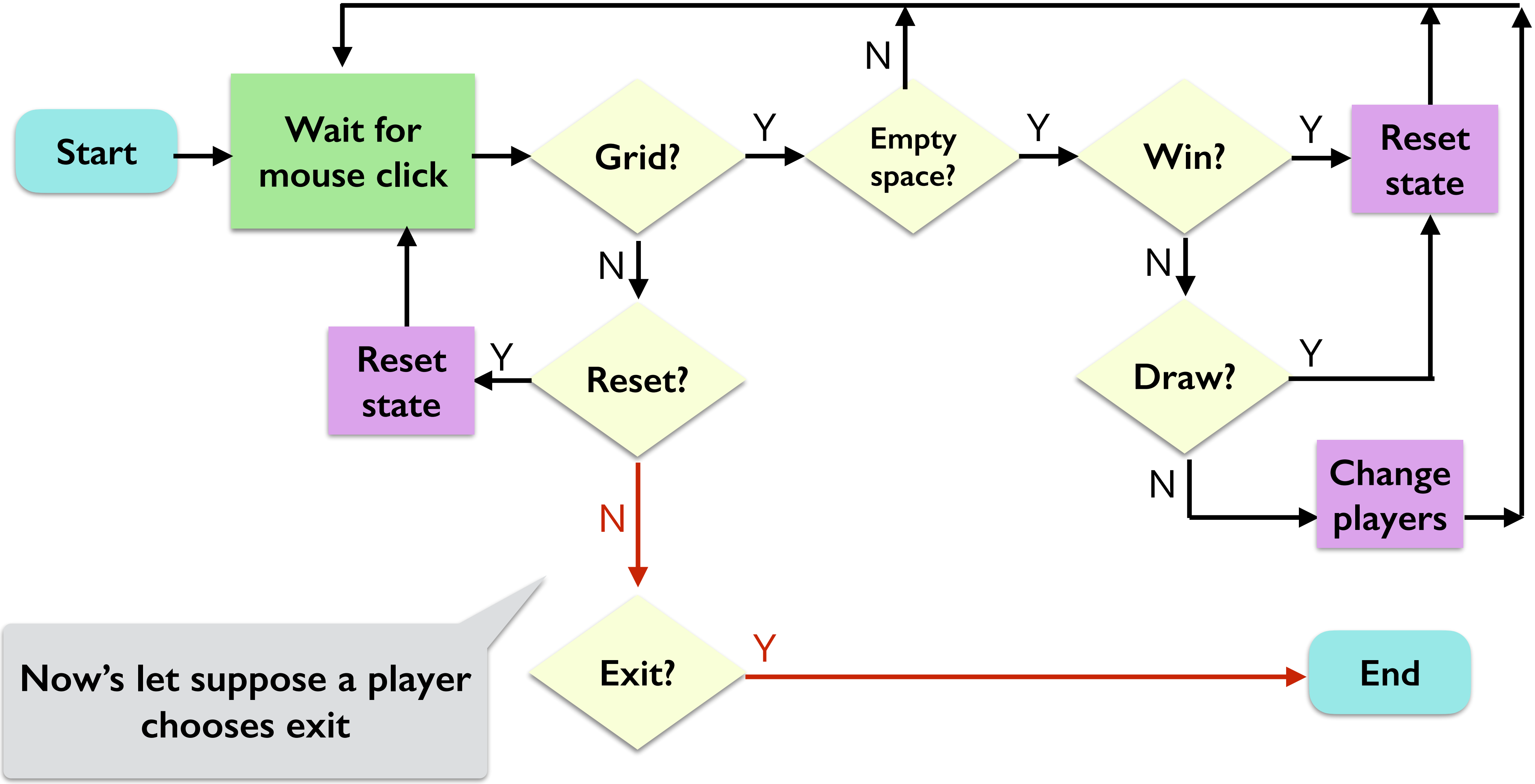
- Let’s create a TTT flowchart to help us think through the state of the game at various stages




Now’s let suppose a player chooses reset

# Finally…TTT Game Logic

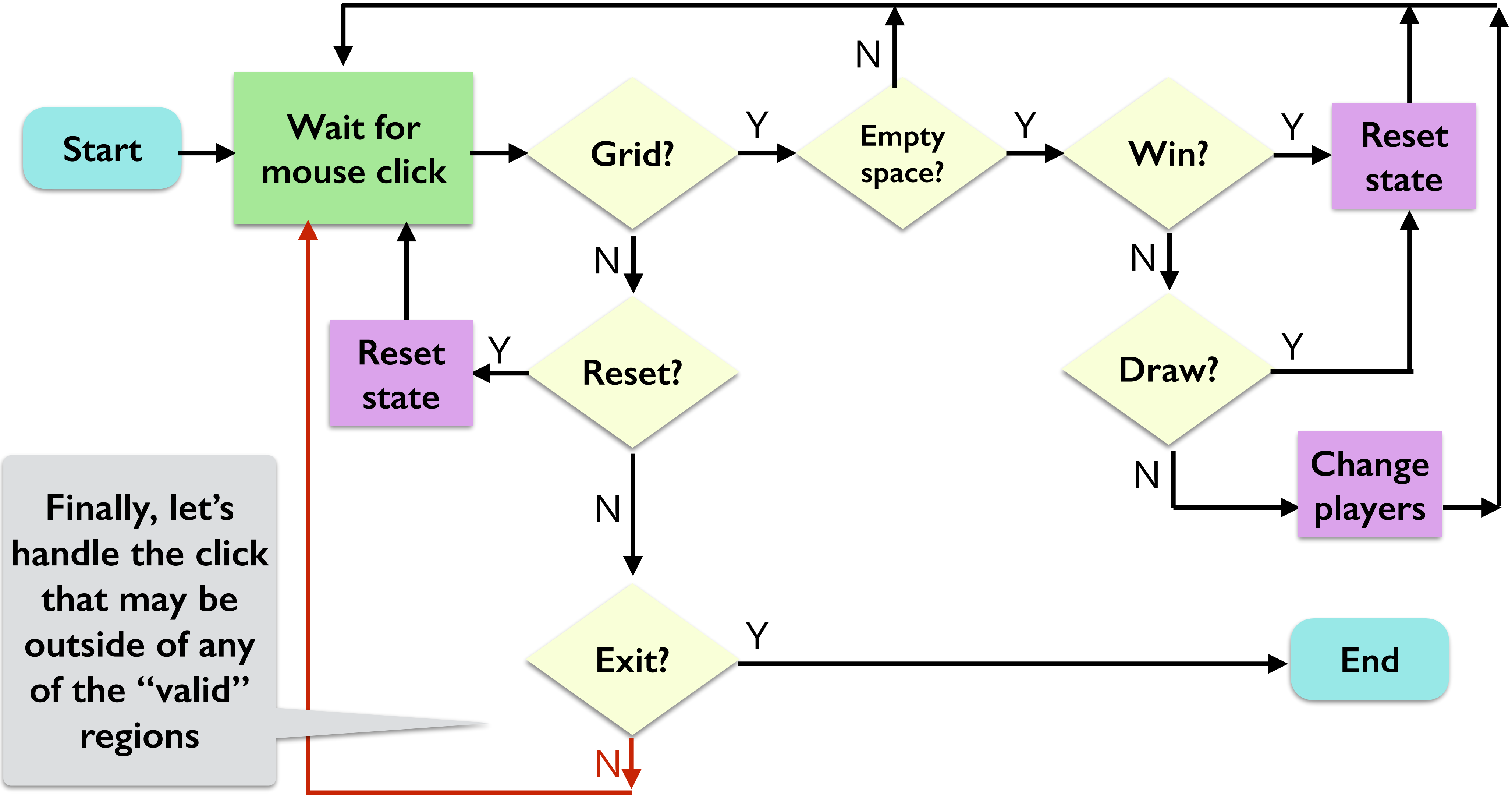
- Let’s create a TTT flowchart to help us think through the state of the game at various stages



Now’s let suppose a player chooses exit

# Finally…TTT Game Logic

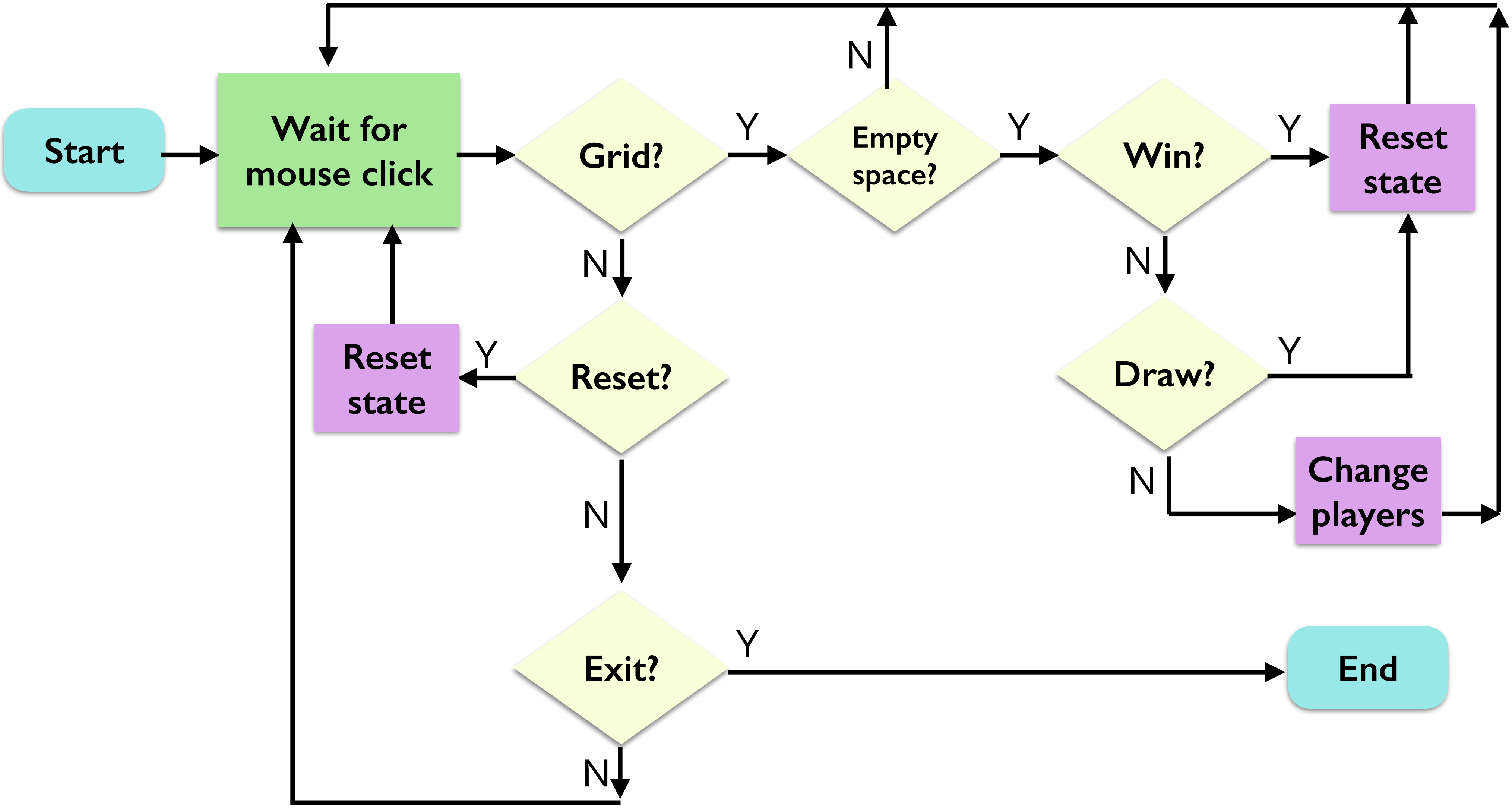
- Let's create a TTT flowchart to help us think through the state of the game at various stages



Finally, let's handle the click that may be outside of any of the "valid" regions

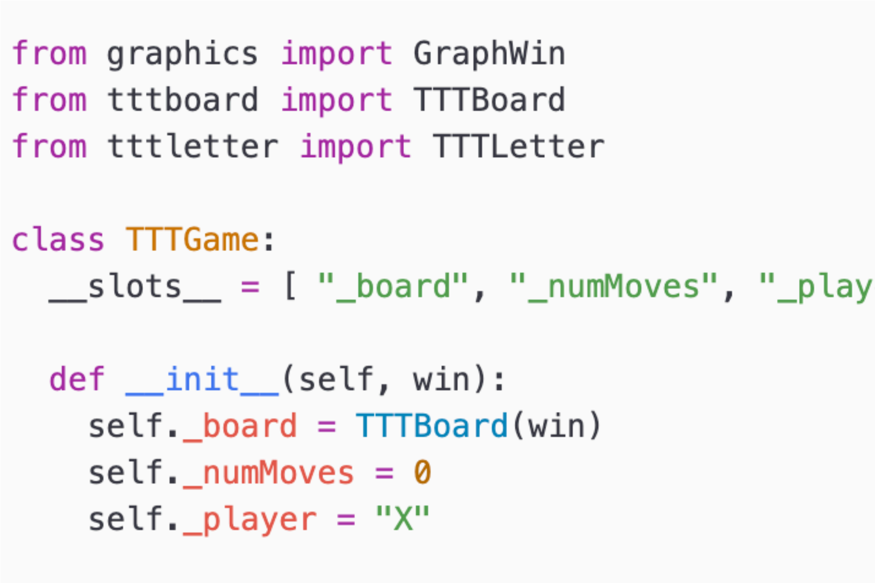
# Finally…TTT Game Logic

- Let's create a TTT flowchart to help us think through the state of the game at various stages

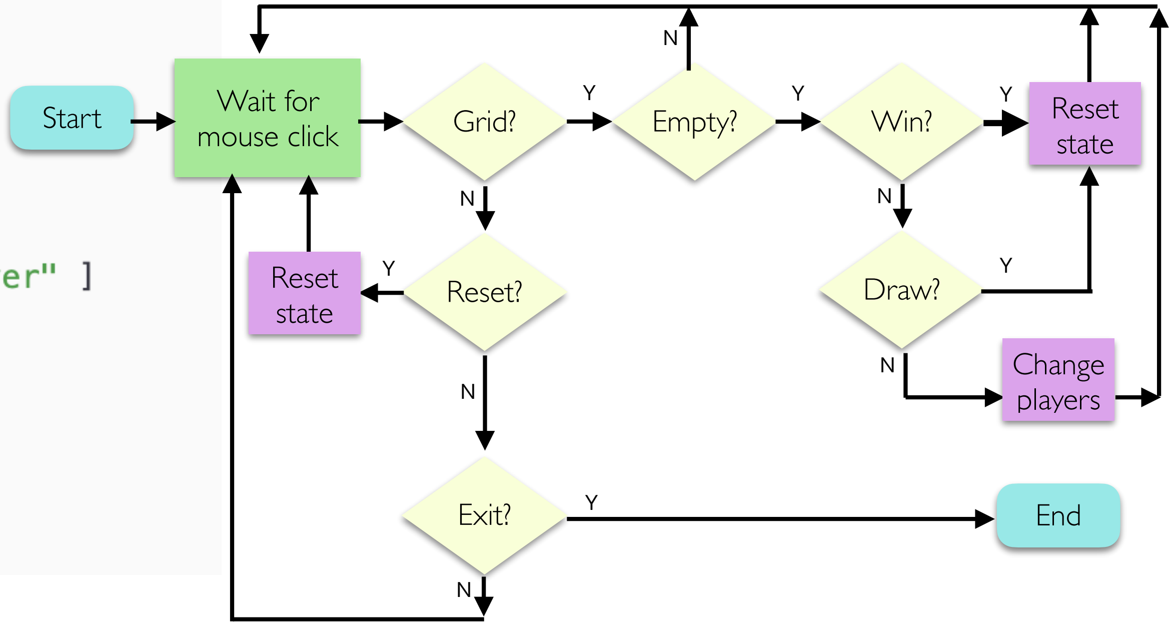


# Translating our Logic to Code

- Let's think about __init__:
  - What do we need?
    - a board, player, and maybe numMoves (to detect draws easily)

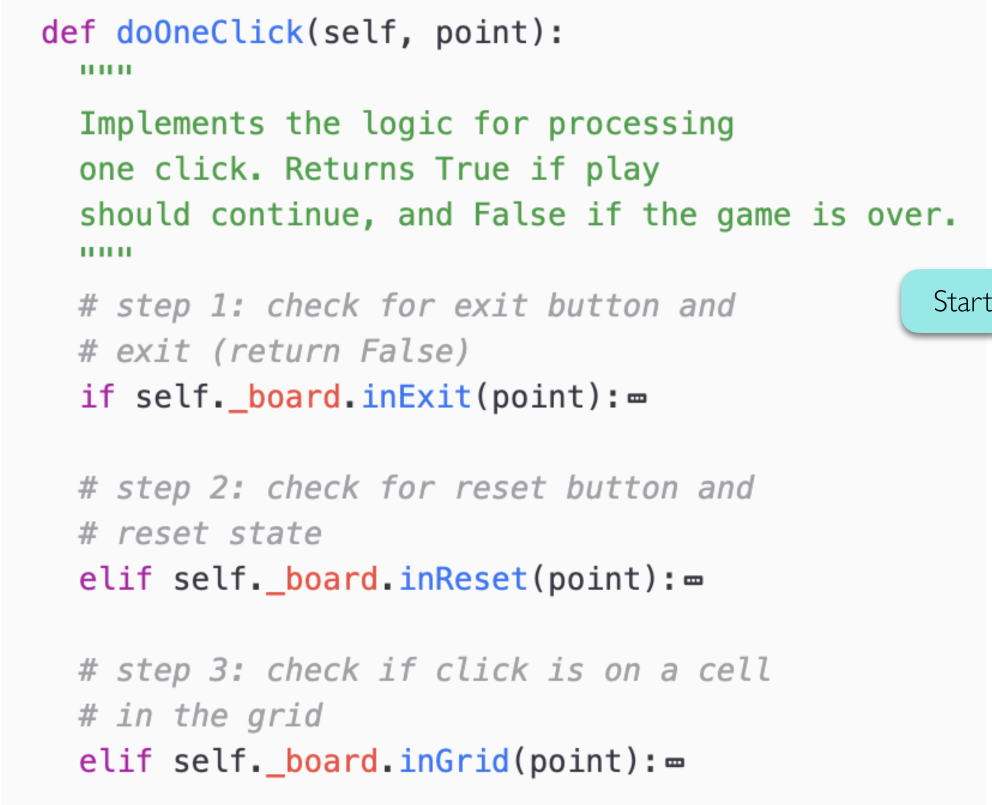


```python
from graphics import GraphWin
from tttboard import TTTBoard
from tttletter import TTTLetter

class TTTGame:
  __slots__ = [ "_board", "_numMoves", "_player" ]

  def __init__(self, win):
    self._board = TTTBoard(win)
    self._numMoves = 0
    self._player = "X"
```

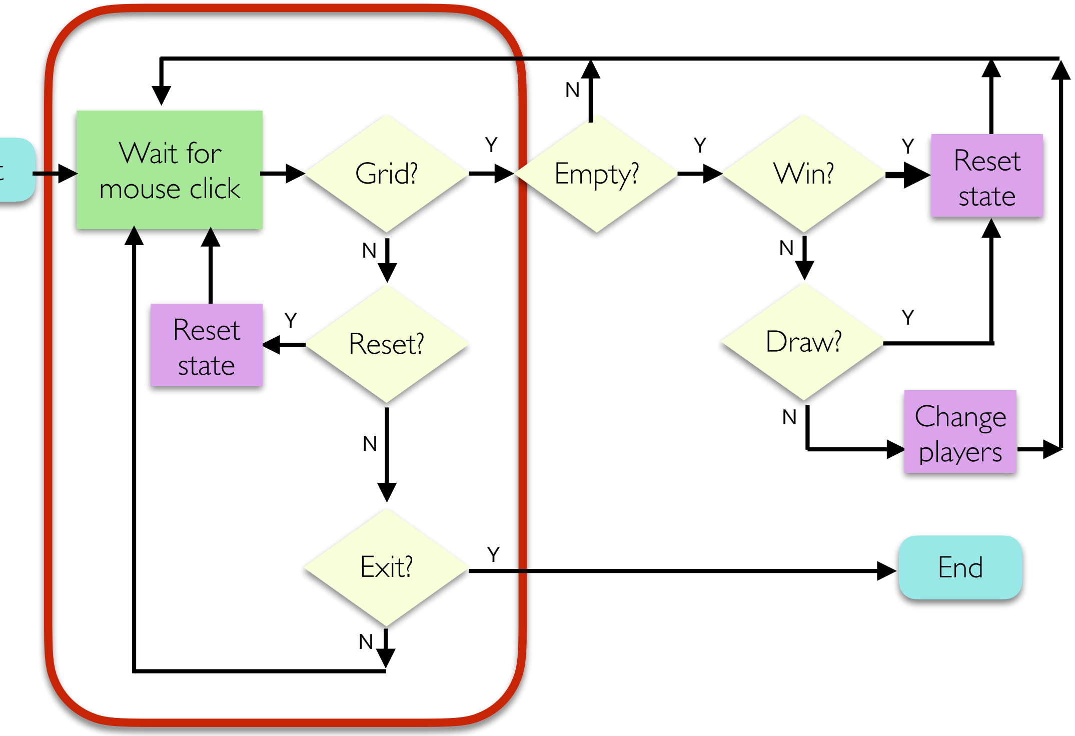


# Translating our Logic to Code

- Now let's write a method for handing a single mouse click (point)
- We need a few if-elif-else checks to handle the grid/reset/exit check
- Let's start with that logic and fill the rest in later

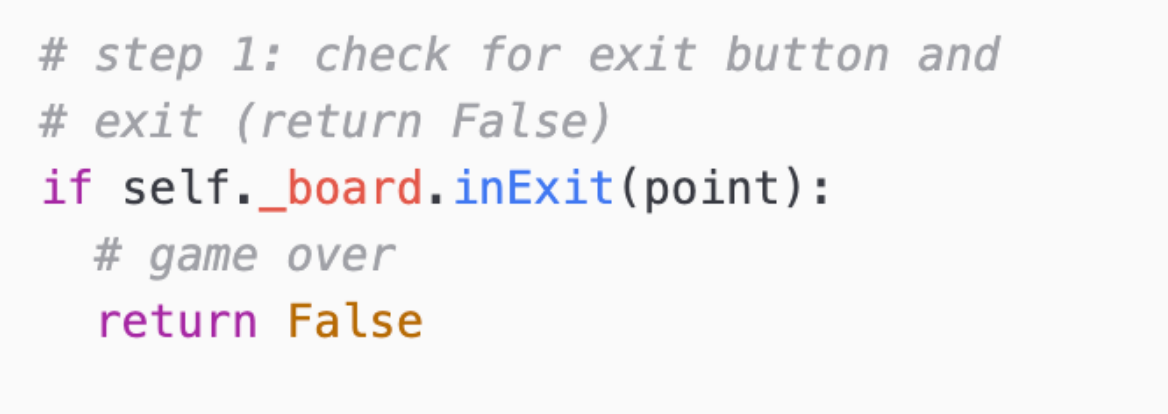


```
def doOneClick(self, point):
  """
  Implements the logic for processing
  one click. Returns True if play
  should continue, and False if the game is over.
  """
  # step 1: check for exit button and
  # exit (return False)
  if self._board.inExit(point):▭

  # step 2: check for reset button and
  # reset state
  elif self._board.inReset(point):▭

  # step 3: check if click is on a cell
  # in the grid
  elif self._board.inGrid(point):▭
```

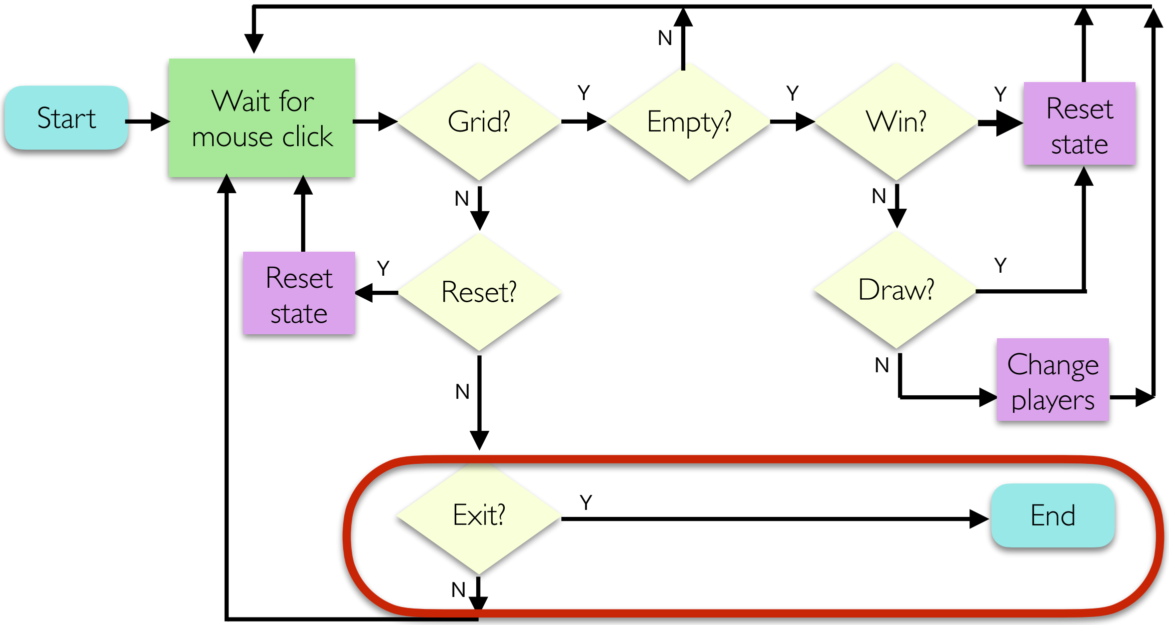


# Translating our Logic to Code

- Let's handle the "exit" button first (since it's the easiest)

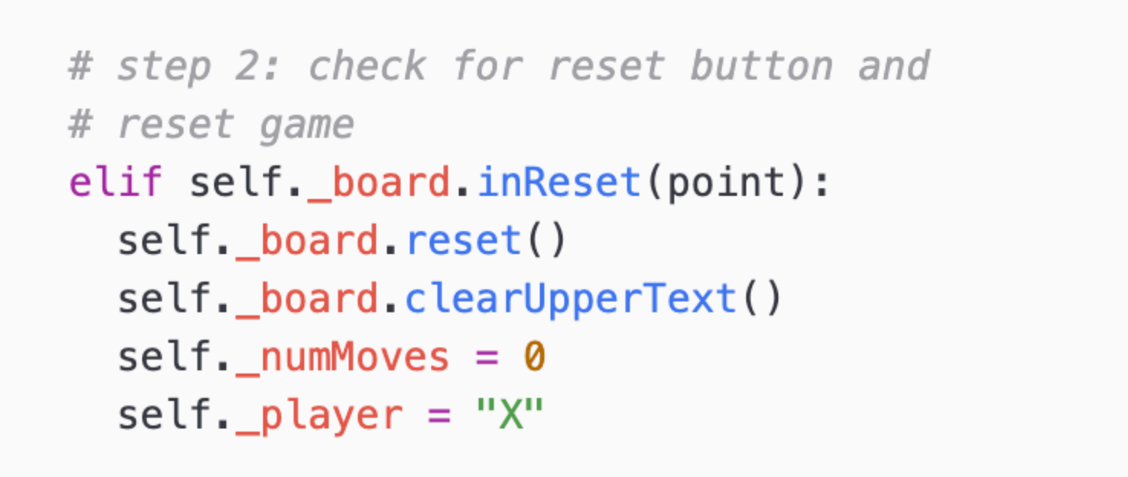


```
# step 1: check for exit button and
# exit (return False)
if self._board.inExit(point):
  # game over
  return False
```

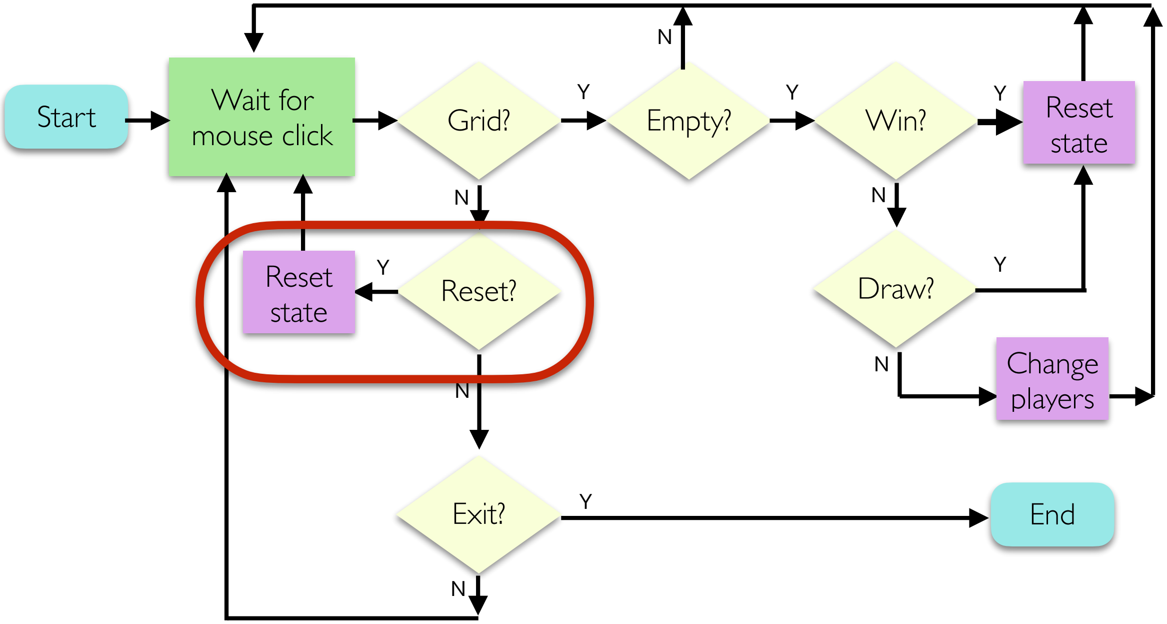


# Translating our Logic to Code

- Now let’s handle reset

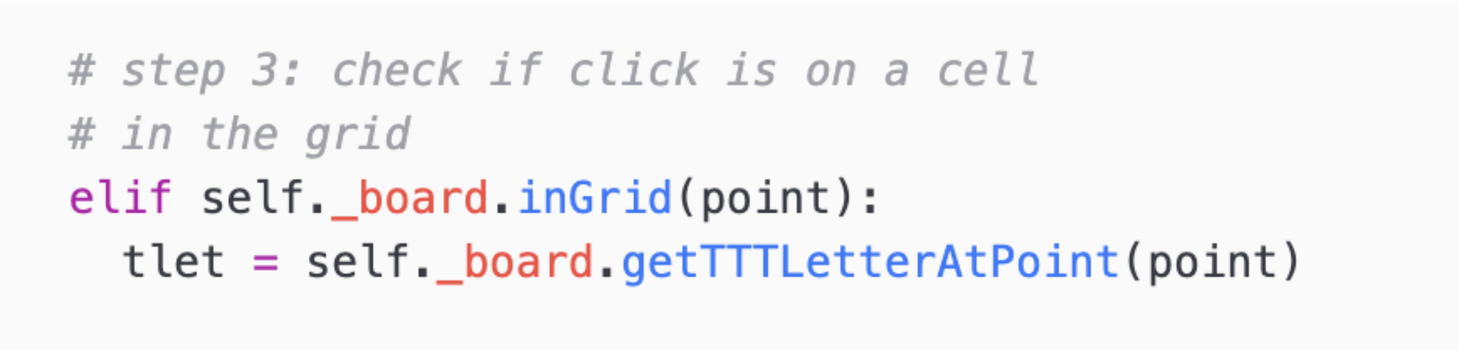


```
# step 2: check for reset button and
# reset game
elif self._board.inReset(point):
  self._board.reset()
  self._board.clearUpperText()
  self._numMoves = 0
  self._player = "X"
```

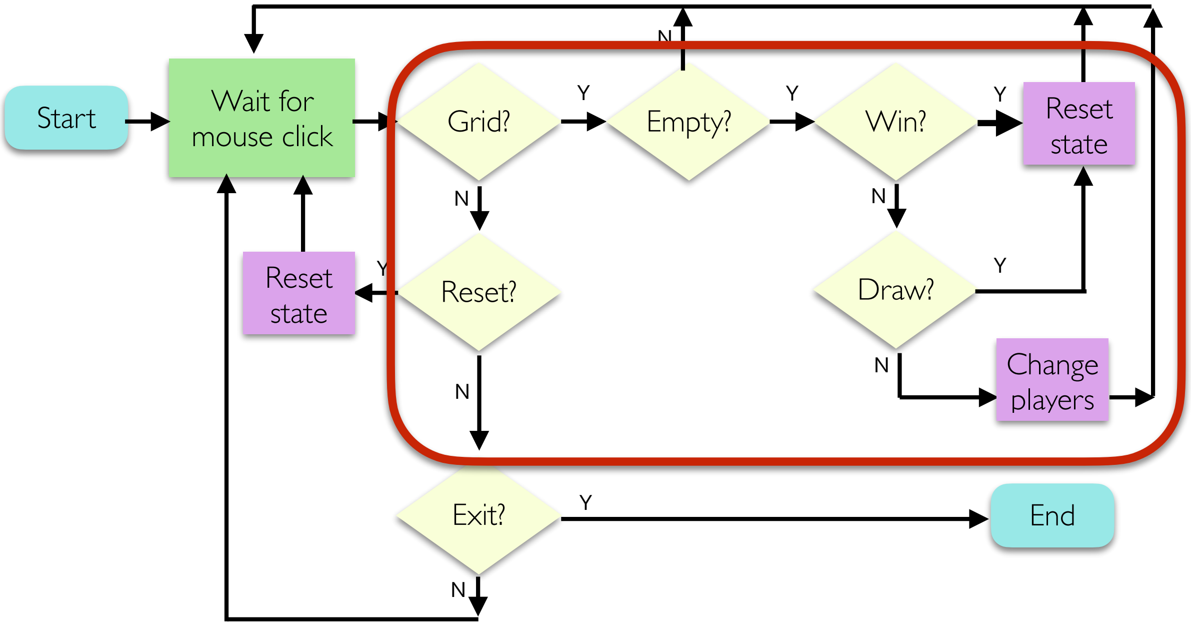


# Translating our Logic to Code

- Finally, let's handle a "normal" move. Start by getting position and TTTLetter

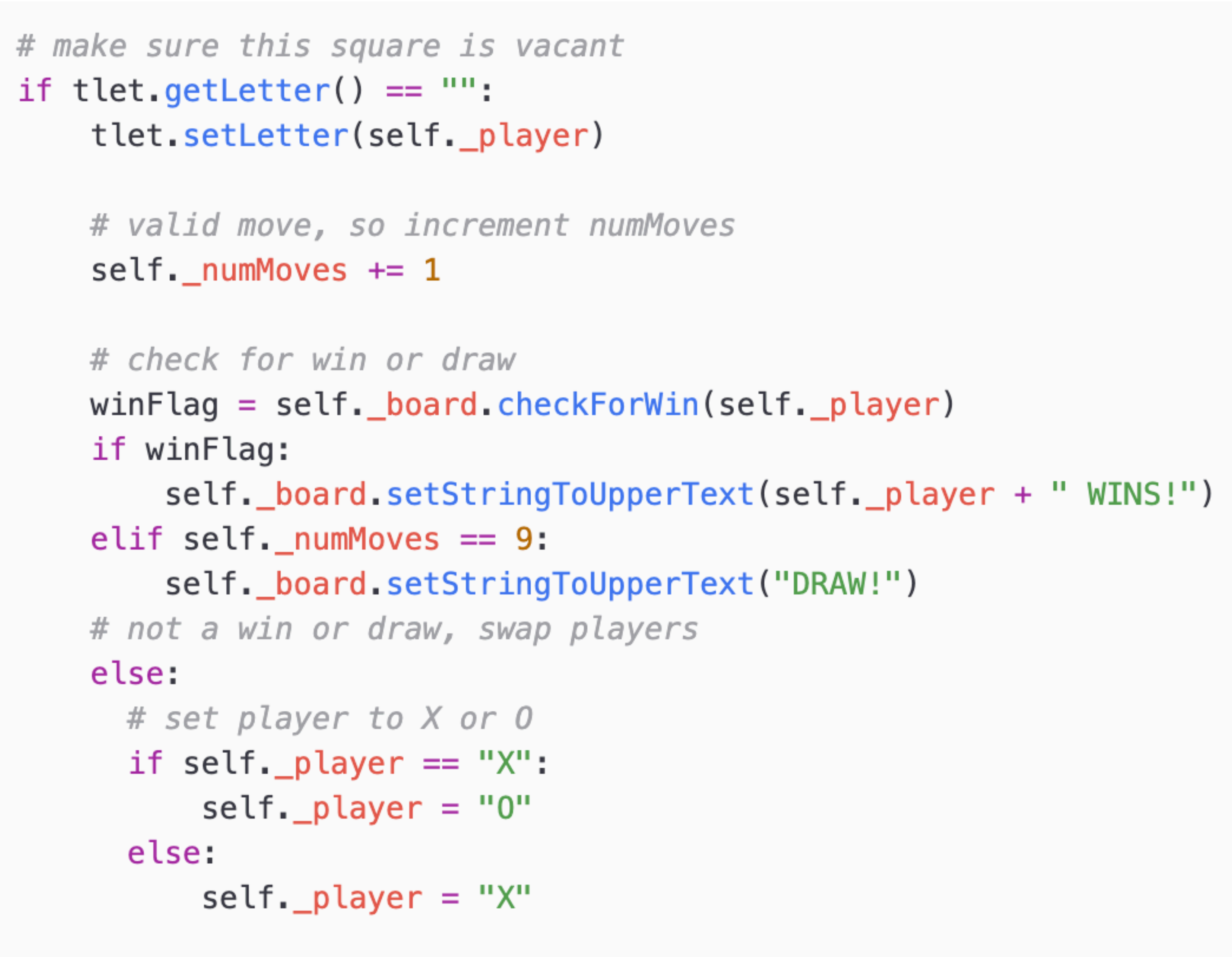


```
# step 3: check if click is on a cell
# in the grid
elif self._board.inGrid(point):
  tlet = self._board.getTTTLetterAtPoint(point)
```



# Translating our Logic to Code

- The rest of our code checks for a valid move, a win, a draw, and updates state accordingly
- At the end, if the move was valid, we swap players



```
# make sure this square is vacant
if tlet.getLetter() == "":
    tlet.setLetter(self._player)

    # valid move, so increment numMoves
    self._numMoves += 1

    # check for win or draw
    winFlag = self._board.checkForWin(self._player)
    if winFlag:
        self._board.setStringToUpperText(self._player + " WINS!")
    elif self._numMoves == 9:
        self._board.setStringToUpperText("DRAW!")
    # not a win or draw, swap players
    else:
      # set player to X or O
      if self._player == "X":
          self._player = "O"
      else:
          self._player = "X"
```

# TTT Summary

- Basic strategy
  - `Board`: start general, don't think about game specific details
  - `TTTBoard`: extend generic board with TTT specific features
    - Inherit everything, overwrite attributes/methods as needed
  - `TTTLetter`: isolate functionality of a single `TTTLetter` on board
    - Think about what features are necessary/helpful in other classes as well
  - `TTTGame`: think through logic conceptually before writing any code
    - Translate logic into code carefully, testing along the way

# Boggle Strategies

- At a high level, Tic Tac Toe and Boggle have a lot in common, but the game state of Boggle is more complicated
- In Lab 9 you should follow a similar strategy to what we did with TTT
- ***Don't forget the bigger picture as you implement individual methods***
- Think holistically about how the objects/classes work together
- Isolate functionality and test often (use `__str__` to print values as needed)
- **Discuss logic with partner before writing any code**
- Worry about common cases first, but don't forget the "edge" cases
- Come see instructors/TAs for clarification

**GOOD LUCK and HAVE FUN!**