CS177 Python Programming

Recitation 3 - Objects and Graphics
Announcements

• If you still did not register to Piazza, please send an e-mail to Ruby

• You cannot submit your lab after the lab is finished.

• Doing the Pre-labs before going to the lab is crucially important. Pre-labs touch the same concepts that we cover in the labs.

• Pre-labs are not graded.
Outline

• Importing a library
• Simple Graphics Programming
• Changing the coordinate system
• Common mistakes
Importing a library

There are 3 ways of importing a library/module.

• >> import math

• >> from math import factorial

• >> from math import *
Importing a library

There are 3 ways of importing a library/module.

• `>> import math`
  - `math.factorial(5)` YES
  - `math.pi` YES
  - `factorial(5)` NO
  - `pi` NO

• `>> from math import factorial`

• `>> from math import *`

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Importing a library

There are 3 ways of importing a library/module.

• >> import math

• >> from math import factorial

• >> from math import *

```
math.factorial(5)  YES
math.pi           YES
factorial(5)      NO
pi                NO
```

```
math.factorial(5)  NO
math.pi           NO
factorial(5)      YES
pi                NO
```
Importing a library

There are 3 ways of importing a library/module.

• >> import math
  - math.factorial(5): YES
  - math.pi: YES
  - factorial(5): NO
  - pi: NO

• >> from math import factorial
  - math.factorial(5): NO
  - math.pi: NO
  - factorial(5): YES
  - pi: NO

• >> from math import *
  - math.factorial(5): NO
  - math.pi: NO
  - factorial(5): YES
  - pi: YES
Simple Graphics Programming

from graphics import *
win = GraphWin("My Window", 200, 400)
win.getMouse()
Simple Graphics Programming

```python
from graphics import *
win = GraphWin("My Window", 200, 400)
win.getMouse()
```
Simple Graphics Programming

from graphics import *
win = GraphWin("My Window", 400, 200)
win.getMouse()
Simple Graphics Programming

```python
from graphics import *
win = GraphWin("My Window", 400, 200)
win.getMouse()
```
Simple Graphics Programming

from graphics import *

win = GraphWin("My Window", 200, 200)

p1 = Point(50,60)
p2 = Point(100,100)
p3 = Point(150,150)
p4 = Point(200,200)

p1.draw(win)
p2.draw(win)
p3.draw(win)
p4.draw(win)

win.getMouse()
Simple Graphics Programming

from graphics import *

win = GraphWin("My Window", 200, 200)

p1 = Point(50,60)
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p4 = Point(200,200)

p1.draw(win)
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p3.draw(win)
p4.draw(win)

win.getMouse()
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win.getMouse()
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win.getMouse()
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Simple Graphics Programming

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p1 = Point(50,60)
p2 = Point(100,100)
p3 = Point(150,150)
p4 = Point(200,200)

p1.draw(win)
p2.draw(win)
p3.draw(win)
p4.draw(win)

win.getMouse()
from graphics import *

def main():
    win = GraphWin("My Window", 500, 500)
    c = Circle(Point(250,250), 200)
    c.draw(win)
    win.getMouse() # pause for click in window
    win.close()

main()
Simple Graphics Programming

```python
from graphics import *

def main():
    win = GraphWin("My Window", 500, 500)
    c = Circle(Point(250,250), 200)
    c.draw(win)
    win.getMouse() # pause for click in window
    win.close()

main()
```
Simple Graphics Programming

from graphics import *

def main():
    win = GraphWin("My Window", 500, 500)
    c = Circle(Point(250,250), 200)
    c.draw(win)
    win.getMouse() # pause for click in window
    win.close()

main()
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def main():
    win = GraphWin("My Window", 500, 500)
    c = Circle(Point(250,250), 200)
    c.draw(win)
    win.getMouse() # pause for click in window
    win.close()

main()
from graphics import *

def main():
    win = GraphWin(“My Window”, 500, 500)
    c = Circle(Point(250,250), 200)
    c.draw(win)
    win.getMouse() # pause for click in window
    win.close()

main()
from graphics import *

def main():
    win = GraphWin("My Window", 500, 500)
    c = Circle(Point(250, 250), 200)
    c.draw(win)
    win.getMouse()  # pause for click in window
    win.close()

main()
from graphics import *

def main():
    win = GraphWin("My Window", 500, 500)
    c = Circle(Point(250,250), 200)
    c.draw(win)
    win.getMouse() # pause for click in window
    win.close()

main()
from graphics import *

def main():
    win = GraphWin("My Window", 500, 500)
    c = Circle(Point(100, 100), 200)
    c.draw(win)
    win.getMouse()  # pause for click in window
    win.close()

main()
from graphics import *

def main():
    win = GraphWin("My Window", 500, 500)
    c = Circle(Point(100, 100), 200)
    c.draw(win)
    win.getMouse() # pause for click in window
    win.close()

main()
from graphics import *

def main():
    win = GraphWin("My Window", 500, 500)
    c = Circle(Point(100, 100), 200)
    c.draw(win)
    win.getMouse() # pause for click in window
    win.close()

main()
from graphics import *

def main():
    win = GraphWin("My Window", 500, 500)
    c = Circle(Point(100, 100), 200)
    c.draw(win)
    win.getMouse() # pause for click in window
    win.close()

main()
from graphics import *

def main():
    win = GraphWin(“My Window”, 500, 500)
    c = Circle(Point(100,100), 100)
    c.draw(win)
    win.getMouse() # pause for click in window
    win.close()

main()
from graphics import *

def main():
    win = GraphWin("My Window", 500, 500)
    c = Circle(Point(100, 100), 100)
    c.draw(win)
    win.getMouse() # pause for click in window
    win.close()

main()
Simple Graphics Programming

from graphics import *

def main():
    win = GraphWin("My Window", 500, 500)
    c = Circle(Point(100,100), 100)
    c.draw(win)
    win.getMouse() # pause for click in window
    win.close()

main()
from graphics import *

def main():
    win = GraphWin("My Window", 500, 500)
    c = Circle(Point(100,100), 100)
    c.draw(win)
    win.getMouse() # pause for click in window
    win.close()

main()
Some graphic functions

- **plot(x, y, color)** Draws the pixel at \((x, y)\) in the window. Color is optional, black is the default

- **setBackground(color)** Sets the window background to the given color. The initial background is gray

- **close()** Closes the on-screen window

- **getMouse()** Pauses for the user to click a mouse in the window and returns where the mouse was clicked as a Point object
plot(x, y, color)

from graphics import *
win = GraphWin("My Window", 200, 200)
win.plot(100,100, 'red')
win.getMouse()
from graphics import *
win = GraphWin("My Window", 200, 200)
win.plot(100,100, 'red')
win.getMouse()
plot(x, y, color)

from graphics import *

win = GraphWin("My Window", 200, 200)

for i in range(80,120):
    win.plot(i, 100, 'red')

win.getMouse()
plot(x, y, color)

from graphics import *

win = GraphWin("My Window", 200, 200)

for i in range(80,120):
    win.plot(i, 100, ‘red’)

win.getMouse()
plot(x, y, color)

from graphics import *

win = GraphWin("My Window", 200, 200)

for i in range(80, 120):
    win.plot(i, 100, 'red')

win.getMouse()
setBackground(color)

from graphics import *

win = GraphWin("My Window", 200, 200)

win.setBackground('yellow')

for i in range(80,120):
    win.plot(50, i, 'black')

win.getMouse()
setBackground(color)

from graphics import *

win = GraphWin("My Window", 200, 200)

win.setBackground('yellow')

for i in range(80,120):
    win.plot(50, i, 'black')

win.getMouse()

Draw your expected output on a piece of paper!
setBackground(color)

define
from graphics import *

win = GraphWin("My Window", 200, 200)

win.setBackground('yellow')

for i in range(80,120):
    win.plot(50, i, 'black')

win.getMouse()
Some graphic functions (contd.)

**Circle methods:**

- `Circle(centerPoint, radius)` Constructs a circle with given center point and radius
- `getCenter()` Returns a clone of the center point of the circle
- `getRadius()` Returns the radius of the circle
Some graphic functions (contd.)

Rectangle Methods:

• Rectangle(point1, point2) Constructs a rectangle having opposite corners at point1 and point2

• getCenter() Returns a clone of the center point of the rectangle
from graphics import *

win = GraphWin("My Window", 200, 200)
rect = Rectangle(Point(50,50), Point(150,150))

rect.draw(win)

centerPoint = rect.getCenter()
print(centerPoint.getX())
print(centerPoint.getY())

win.getMouse()
Rectangle(point1, point2)

from graphics import *

win = GraphWin("My Window", 200, 200)
rect = Rectangle(Point(50,50), Point(150,150))
rect.draw(win)

centerPoint = rect.getCenter()
print(centerPoint.getX())
print(centerPoint.getY())

win.getMouse()
from graphics import *

win = GraphWin("My Window", 200, 200)
rect = Rectangle(Point(50,50), Point(150,150))
rect.draw(win)

centerPoint = rect.getCenter()
print(centerPoint.getX())
print(centerPoint.getY())

win.getMouse()
Rectangle(point1, point2)

from graphics import *

win = GraphWin("My Window", 200, 200)
rect = Rectangle(Point(50,50), Point(150,150))

rect.draw(win)

centerPoint = rect.getCenter()
print(centerPoint.getX())
print(centerPoint.getY())

win.getMouse()
Line(point1, point2)

from graphics import *

win = GraphWin("My Window", 200, 200)

line = Line(Point(25,25), Point(175,175))

line.draw(win)

win.getMouse()
Line(point1, point2)

from graphics import *

win = GraphWin("My Window", 200, 200)

line = Line(Point(25,25), Point(175,175))

line.draw(win)

win.getMouse()

Draw your expected output on a piece of paper!
Line(point1, point2)

from graphics import *

win = GraphWin("My Window", 200, 200)

line = Line(Point(25,25), Point(175,175))

line.draw(win)

win.getMouse()
from graphics import *

win = GraphWin("My Window", 200, 200)

line1 = Line(Point(a, b), Point(c, d))
line2 = Line(Point(i, j), Point(k, l))

line1.draw(win)
line2.draw(win)

win.getMouse()
from graphics import *

win = GraphWin("My Window", 200, 200)
line1 = Line(Point(a, b), Point(c, d))
line2 = Line(Point(i, j), Point(k, l))
line1.draw(win)
line2.draw(win)
win.getMouse()

How to draw this?

Write your expected a, b, c, d, i, j, k, l on a piece of paper.

What are the values:
a, b, c, d
i, j, k, l
???
Line(point1, point2)

from graphics import *
win = GraphWin("My Window", 200, 200)
line = Line(Point(25,25), Point(175,175))
line.draw(win)
win.getMouse()
from graphics import *

win = GraphWin("My Window", 200, 200)
line1 = Line(Point(25, 175), Point(175,25))
line2 = Line(Point(25, 100), Point(175,100))
line1.draw(win)
line2.draw(win)
win.getMouse()
from graphics import *

win = GraphWin("My Window", 200, 200)

line1 = Line(Point(25, 25), Point(175, 175))
line1.draw(win)

win.getMouse()

Swapping lines change anything?
Line(point1, point2)

from graphics import *

win = GraphWin("My Window", 200, 200)
line = Line(Point(25,25), Point(175,175))
line.draw(win)

win.getMouse()

Write your expected answer. Yes/No?

Swapping lines change anything?
from graphics import *

win = GraphWin("My Window", 200, 200)
line1 = Line(Point(25, 175), Point(175, 25))
line2 = Line(Point(25, 100), Point(175, 100))
line1.draw(win)
line2.draw(win)
win.getMouse()

Swapping lines change anything?

No.

from graphics import *

win = GraphWin("My Window", 200, 200)
line1 = Line(Point(25, 175), Point(175, 25))
line2 = Line(Point(25, 100), Point(175, 100))
line1.draw(win)
line2.draw(win)
win.getMouse()
Changing the coordinate system

from graphics import *

win = GraphWin("My Window", 200, 200)

# win.setCoords(0, 0 , 200, 200)

rect = Rectangle(Point(25,25), Point(75,75))
rect.draw(win)

win.getMouse()
Changing the coordinate system

Sets the coordinate system of the window. The lower-left corner is \((x_{ll}, y_{ll})\) and the upper-right corner is \((x_{ur}, y_{ur})\).

All subsequent drawing will be done with respect to the altered coordinate system (except for plotPixel).

# setCoords(xll, yll, xur, yur)
# xll: x lower left
# yll: y lower left
# xur: x upper right
# yur: y upper right
Changing the coordinate system

from graphics import *

win = GraphWin("My Window", 200, 200)

# win.setCoords(0, 0, 200, 200)
rect = Rectangle(Point(25,25), Point(75,75))
rect.draw(win)

win.getMouse()
Changing the coordinate system

from graphics import *

win = GraphWin("My Window", 200, 200)

# win.setCoords(0, 0, 200, 200)

rect = Rectangle(Point(25,25), Point(75,75))
rect.draw(win)

win.getMouse()
Changing the coordinate system

from graphics import *

win = GraphWin("My Window", 200, 200)
win.setCoords(0, 0, 200, 200)
rect = Rectangle(Point(25,25), Point(75,75))
rect.draw(win)
win.getMouse()

# setCoords(xll, yll, xur, yur)
# xll: x lower left
# yll: y lower left
# xur: x upper right
# yur: y upper right
Changing the coordinate system

from graphics import *

win = GraphWin("My Window", 200, 200)

win.setCoords(0, 0 , 200, 200)

rect = Rectangle(Point(25,25), Point(75,75))
rect.draw(win)

win.getMouse()
Changing the coordinate system

```python
from graphics import *

win = GraphWin("My Window", 200, 200)
win.setCoords(0, 0 , 200, 200)
rect = Rectangle(Point(25,25), Point(75,75))
rect.draw(win)
win.getMouse()
```

# setCoords(xll, yll, xur, yur)
# xll: x lower left
# yll: y lower left
# xur: x upper right
# yur: y upper right

The position of the rectangle is changed!
Changing the coordinate system

from graphics import *

win = GraphWin("My Window", 200, 200)

# win.setCoords(0, 0, 200, 200)

rect = Rectangle(Point(25,25), Point(75,75))
rect.draw(win)

win.getMouse()
Changing the coordinate system

from graphics import *

win = GraphWin("My Window", 200, 200)

# win.setCoords(0, 0, 200, 200)

rect = Rectangle(Point(25,25), Point(75,75))
rect.draw(win)

win.getMouse()
Changing the coordinate system

```python
from graphics import *

win = GraphWin("My Window", 200, 200)
# win.setCoords(0, 0, 200, 200)
rect = Rectangle(Point(25,25), Point(75,75))
rect.draw(win)
win.getMouse()
```

```python
from graphics import *

win = GraphWin("My Window", 200, 200)
win.setCoords(200, 0, 0, 200)
rect = Rectangle(Point(25,25), Point(75,75))
rect.draw(win)
win.getMouse()
```
Changing the coordinate system

from graphics import *

win = GraphWin("My Window", 200, 200)

# win.setCoords(0, 0 , 200, 200)

rect = Rectangle(Point(25,25), Point(75,75))
rect.draw(win)

win.getMouse()

What are the values of a, b, c and d to get the same output?
Changing the coordinate system

```python
from graphics import *
win = GraphWin("My Window", 200, 200)
# win.setCoords(0, 0, 200, 200)
rect = Rectangle(Point(25,25), Point(75,75))
rect.draw(win)
win.getMouse()
```

What are the values of a, b, c, and d to get the same output?

Write your expected a, b, c, and d to a piece of paper.
Changing the coordinate system

Both programs produce the same output.
from graphics import *

win = GraphWin("My Window", 200, 200)
rect = Rectangle(Point(50,50), Point(150,150))

Rectangle.draw(win)

win.getMouse()
Common mistakes

from graphics import *

win = GraphWin("My Window", 200, 200)
rect = Rectangle(Point(50,50), Point(150,150))
rect.draw(win)
win.getMouse()
Common mistakes

from graphics import *

win = GraphWin("My Window", 200, 200)
rect = Rectangle(50,50,150,150)
rect.draw(win)
win.getMouse()
Common mistakes

from graphics import *

win = GraphWin("My Window", 200, 200)
rect = Rectangle(50,50,150,150)
rect.draw(win)

win.getMouse()
More exercises

• Draw a **Rectangle** with only using **Line**’s for given point1 and point2.

• Draw a **line** with only using `plot(x, y, color)` for given point1 and point2.

• Draw a circle with only using `plot(x, y, color)`. **Hint:** You may need to use **math** library.
A good summary:

by the people who wrote the library

http://mcsp.wartburg.edu/zelle/python/graphics/graphics.pdf
Questions?

Thanks