Project 3

PYTHON OBJECT MODEL

OBJECT ORIENTED DESIGN

Graphics

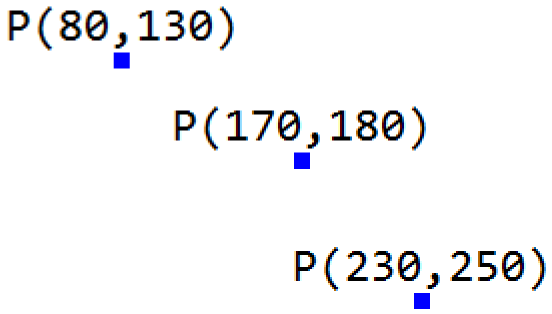
- Download the file graphics.py from the link:

https://samyzaf.com/braude/PYTHON/projects/graphics.py

- This file implements our graphical environment. Specifically, it defines a canvas window on which we can draw points, lines, rectangles, and other geometrical shapes
- There is no need to read or understand the code in this module
- It is based on the the Tkinter module, which is the simplest graphics environment that comes with any Python distribution and is therefore always available
- If you want to experiment with graphics programming, you may start with:
http://www.tkdocs.com/tutorial/

The Point Abstract Data Type

- p = Point(x,y) [constructor]
  - Create a new point **p** from two integers: x, y
  - Our domain is the two-dimensional plane for abstract circuit design (CAD system)
- p.x = x coordinate [field]
- p.y = y coordinate [field]
- p.move(dx, dy) [mutator]
  - Move the point p to new coordinates: **x+dx, y+dy**
- p.draw() [accessor]
  - Draw the point on the screen
- p.text(t) [accessor]
  - Draw a texts string **t** above the point



Test Driven Development

- Reminder: in test driven methodology you write your tests before the implementation of your ADT !!!
- After implementation, your tests should run and **PASS** after each modification you make to your implementation (“nightly test regression”)
- The following tests are your “insurance policy” that your implementation is correct. The more tests you write, the more you’re insured

```
# Testing our Point ADT: test 1
def test1():
    print "===== Testing The Point Class ====="
    p1 = Point(20,20)
    p2 = Point(50,60)
    print "Testing the Python print statement on Point p1:"
    print p1
    print "Testing the Python print statement on Point p2:"
    print p2
    print "Test 1: PASSED"
```

Test Driven Development

- Here is a more formal and practical test

```
def test2():
    p1 = Point(20,20)
    p2 = Point(50,60)
    assert p1.x == 20 and p1.y == 20
    assert p2.x == 50 and p2.y == 60
    p1.move(100, 200)
    p2.move(100, 200)
    assert p1.x == 120 and p1.y == 220
    assert p2.x == 150 and p2.y == 260
    print "Test 2: PASSED"
```

Point Implementation

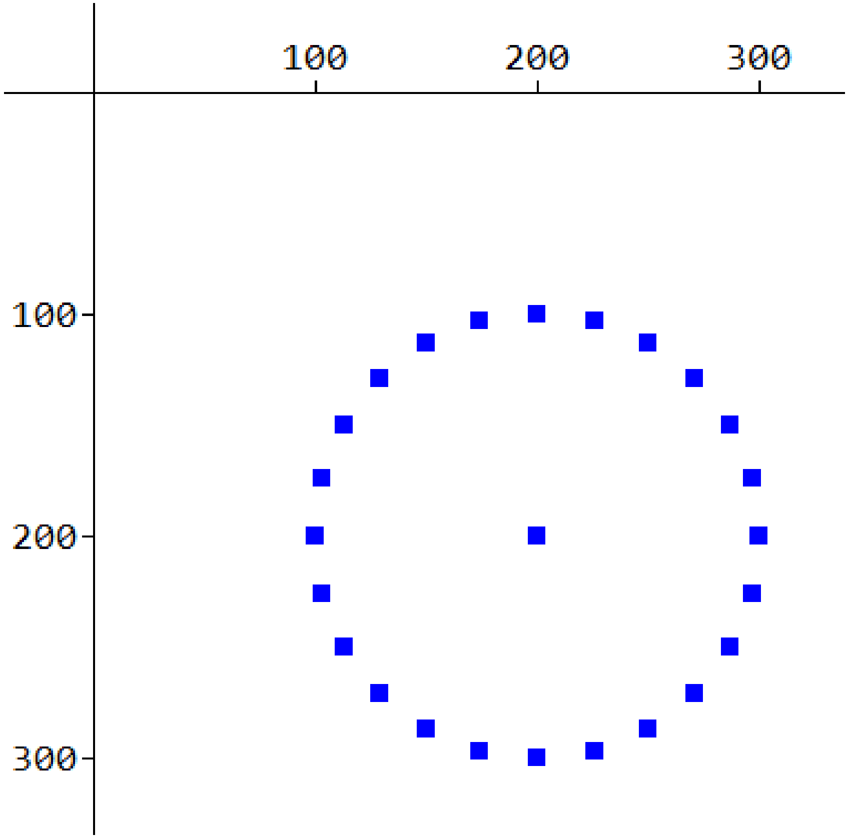
- Download the file point.py from the link:

https://samyzaf.com/braude/PYTHON/projects/point.py

- We shall spend a few minutes in lab for reading and discussing the code before you start your work

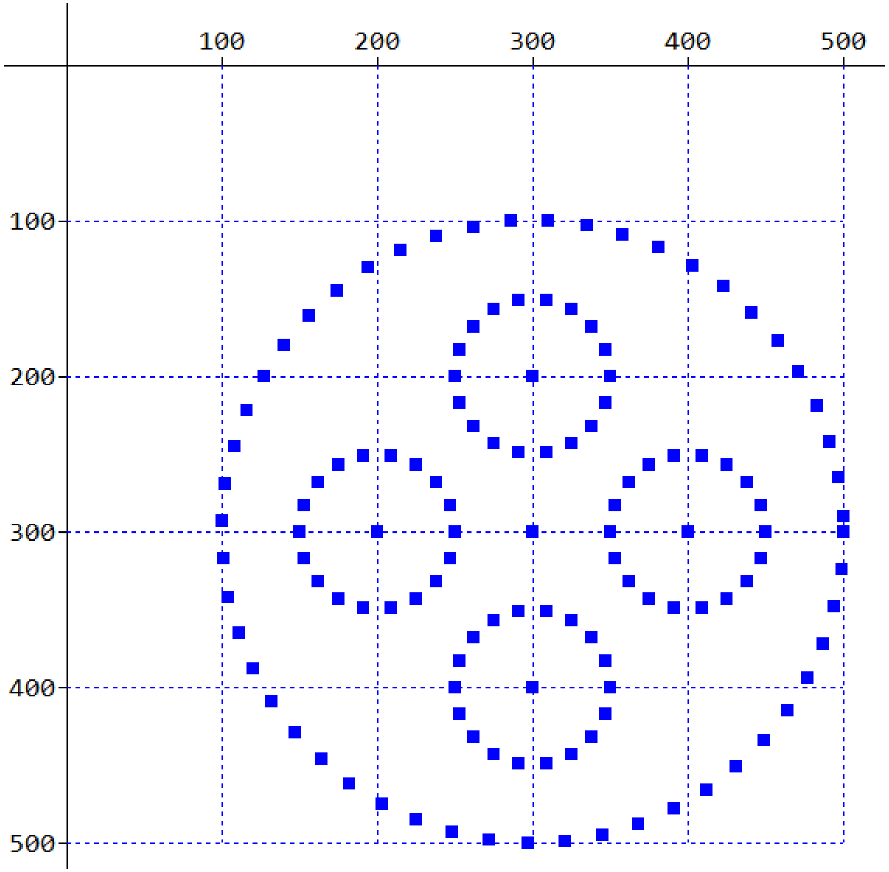
Problem 1

- Write a function make_ring() which draw 24 points on a circle with center=(200,200) and radius=100:



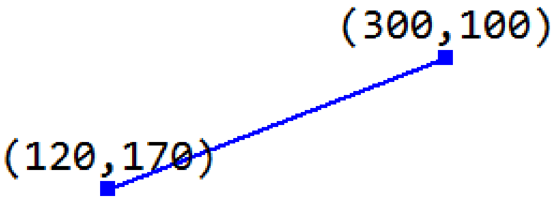
Problem 2

- Design and write a class Ring which can be used to draw rings as follow
- Hint:
  - the big circle center is: (300,300), radius=200, and it has 48 points
  - The small circle radius=50, has 18 points, and the centers are easy to compute



The Line Abstract Data Type (1)

- `l = Line(p1,p2)` [constructor]
  - Create a new line object **l** from two point objects: **p1**, **p2**
- `l.p1    get the first point` [field]
- `l.p2    get the second point` [field]
- `l.move(dx, dy)` [mutator]
  - Move the line `l` by **dx** units horizontally and **dy** units vertically
- `l.length()` [accessor]
  - Return line length – the distance between the points p1 and p2
- `l.middle()` [accessor]
  - Return the middle point of this line (as a Point object!)
- `l.draw()` [accessor]
  - Draw the line on a canvas



Line Implementation

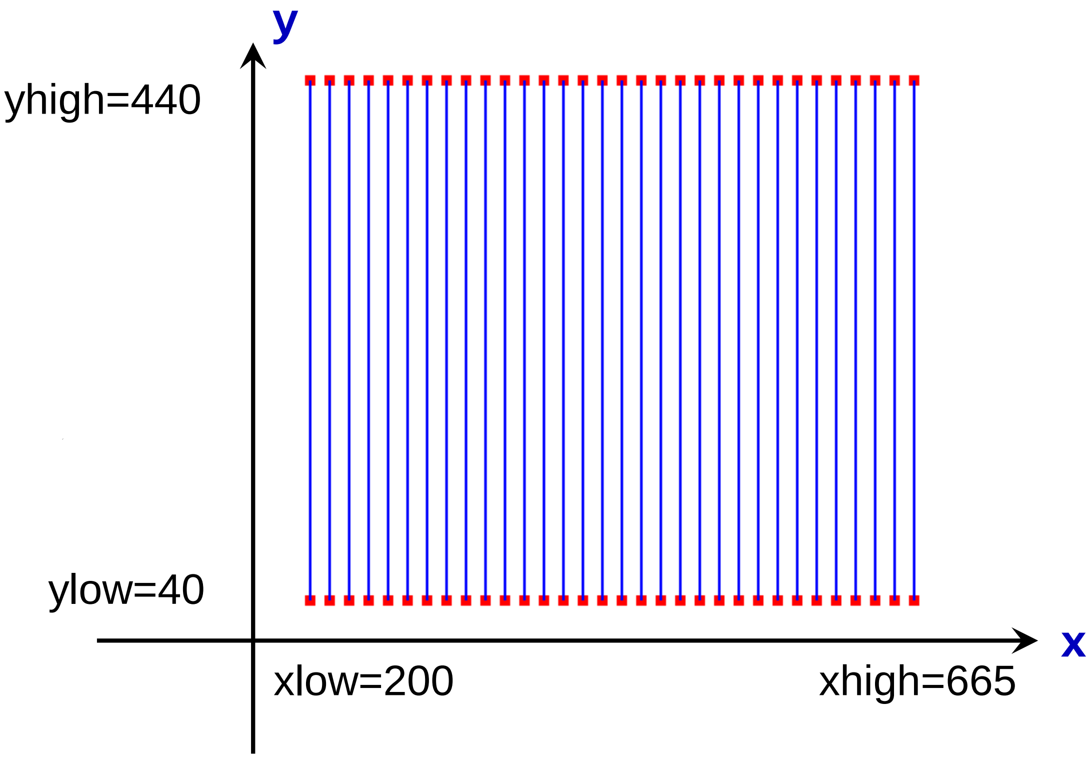
- Download the file line.py from the link:

https://samyzaf.com/braude/PYTHON/projects/line.py

- This file contains an implementation of the Line class

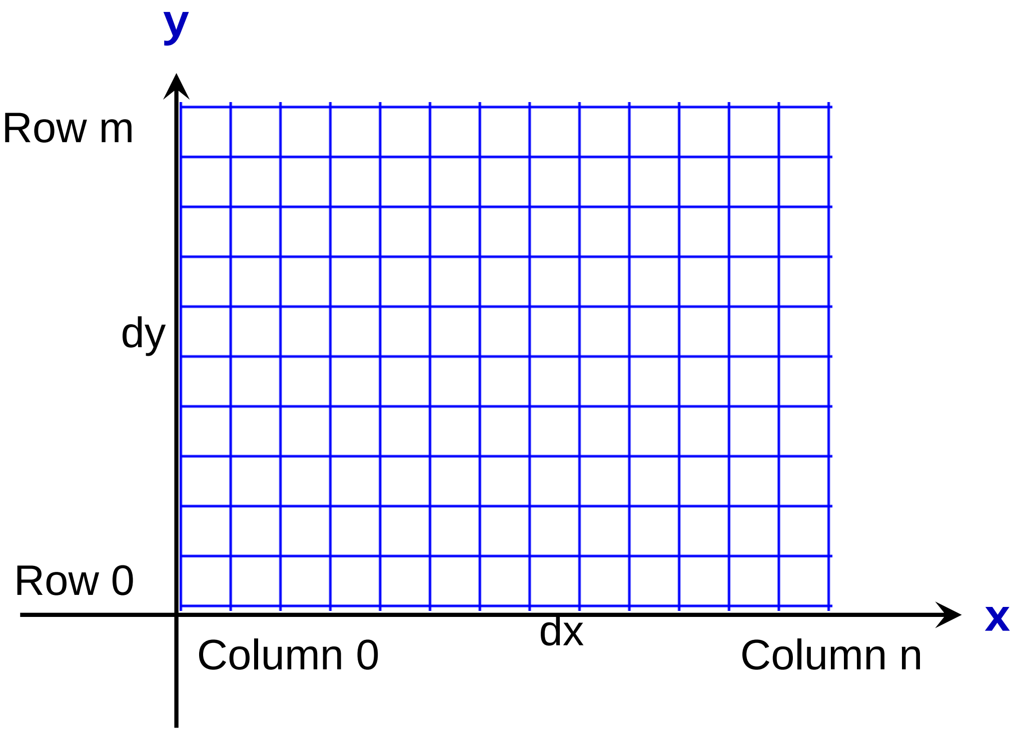
Problem 3: VLSI BUS

- A simple **VLSI BUS** consists of a well structured group of lines (sometimes called “signals” or “bits”)
- Write a function **`draw_bus()`** for drawing a 32 bits **BUS** with the following characteristics: **`xlow = 200`**, **`xhigh=665`**, **`dx=15`**, **`ylow=40`**, **`yhigh=440`**
- Make sure to draws the points too!



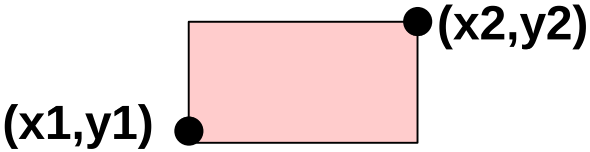
Problem 4: VLSI GRID

- A simple **VLSI GRID** consists of an equally spaced horizontal and vertical lines as in the bottom figure
- Write a short function **draw_grid(m,n,dx,dy)** for drawing an **mxn** grid such that the distance between vertical lines is dx, and distance between horizontal lines is dy



The Rectangle Abstract Data Type

- `r = Rectangle(x1,y1,x2,y2)` [constructor]
  - Create a new rectangle **r** from four integers: x1, y1, x2, y2
  - Our domain is the two-dimensional plane for abstract circuit design (CAD system)
- `r.draw()`



- `r.x1` = x1 coordinate field [field]
- `r.y1` = y1 coordinate field [field]
- `r.x2` = x2 coordinate field [field]
- `r.y2` = y2 coordinate field [field]
- `r.move(dx, dy)` [mutator]
  - Move the rectangle r to new coordinates: `x1+dx, y1+dy, x2+dx, y2+dy`
- `r.area()` [accessor]
- `r.width()` [accessor]
- `r.height()` [accessor]
- `r.center()` [accessor]

Test Driven Development

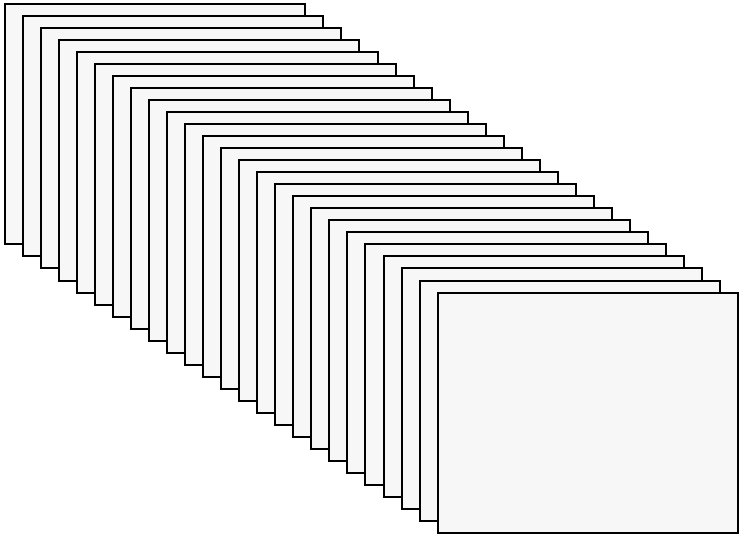
- Download the rectangle module from:
  http://brd4.braude.ac.il/~samyz/cgi-bin/view_file.py?file=PYTHON/projects/rectangle.py
- Here is a simple code for testing the Rectangle class
  Make sure it runs and is PASSED

```
# Testing our Rectangle ADT: test 1

def test1():
    r = Rectangle(30, 20 ,80, 70)
    assert r.area() == 2500
    assert r.width() == 50
    assert r.height() == 50
    r.move(15,25)
    assert r.x1 == 45
    assert r.y2 == 95
    assert r.area() == 2500
    print "Test PASSED"
```

Problem 5: Graphical Application

- Look at the simple Python implementation of the Rectangle ADT at project #3 section in the Python course web site: https://samyzaf.com/braude/PYTHON/#project3
- Note that this implementation also contains a draw() method !
- **Problem 10:**
  Use this implementation to write a short script that produces the following effect:



Hint:
r = Rectangle(10, 10 ,160, 130)
dx = 9, dy = 6, there are 25 rectangles
The solution is test3() in the above file … but try first before you look it up!

Problem 6: Textfile Class

- Download the file textfile.py from the link:

https://samtzaf.com/braude/PYTHON/projects/textfile.py

- This file implements the **Textfile** class for analyzing words frequency in large text files
- Read the usage description at the beginning of the file
- Use the Textfile class to find the 10 most used words in the book:

  https://samyzaf.com/braude/PYTHON/projects/jude.txt
- Also indicate how many times each of these words appear in the book?
- Make sure to write a function that can be reused for other books …

Problem 7: most common words

- Write a function `most_common_words(file, n)` which accepts a text file name and an integer n and prints the n most frequent words in the file and their frequency count:

```
file = "D:/BRAUDE/PYTHON/Projects/proj1/proj1.txt"

most_frequent_words(file, 10)
     1.  the     88
     2.  of      57
     3.  a       52
     4.  in      47
     5.  is      34
     6.  and     32
     7.  are     27
     8.  to      25
     9.  numbers 16
    10.  cards   15

Hint: start with  tf = Textfile(file)
```