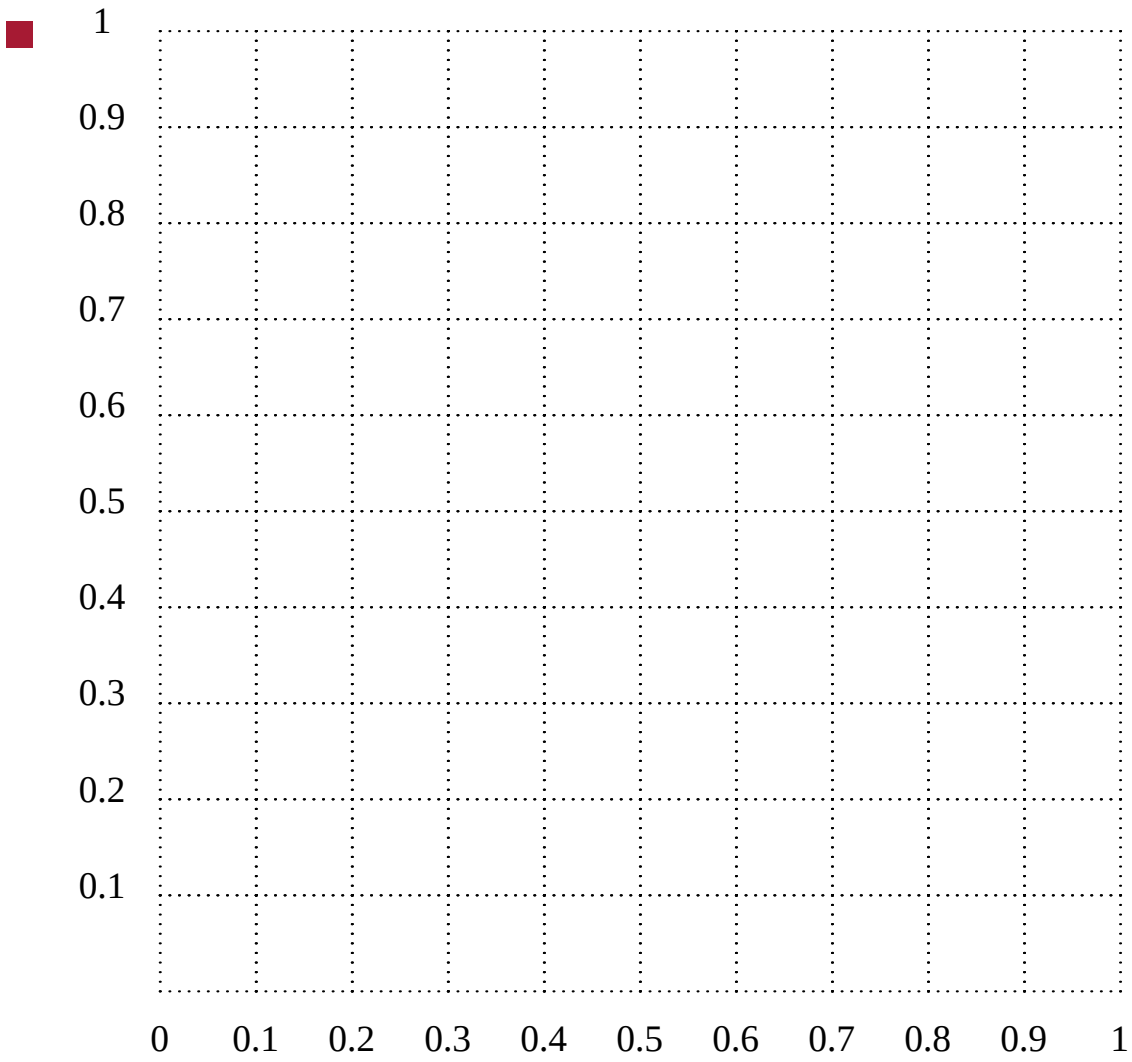
PGE Introduction

- PGE is a Predictive physics Game Engine
  - it operates by predicting the time of next collision rather than using a frame based approach

PGE Screen and world coordinates 1m x 1m



PGE works with Python and Pygame

- PGE allows you to create an object and give it physical attributes and pygame will draw the image
  - the object will behave as it would in the real world (almost!)
- you can interfere with the object using mouse and keyboard input
- your program can also modify the PGE world

PGE Python API

- is powerful enough to implement breakout in about 2 hours
- the Python interface allows you to:
  - define call backs to occur when objects collide
  - define timer functions to execute in the future
- you can also change an objects attribute (velocity/acceleration) in Python

PGE Objects

- colour
- circle
  - can be declared at any level
- polygon
  - can be declared at any level
- text
  - can be declared at any level other than level 0
- springs
  - can only be declared at level 0

PGE Objects

- only objects at level 0 are handled by the physics engine
  - objects declared at any level < 0 are in the background
  - objects declared at any level > 0 are in the foreground
- all objects are drawn in level order
- you **must** include a boarder to the PGE world
  - a picture frame to enclose all objects
- you **must** give a mass to non fixed objects

Simple example

tinypge.py

```
#!/usr/bin/env python

import pge, sys
from pygame.locals import *


print ``starting pge''
# pge.batch ()
pge.interactive ()

wood_light = pge.rgb (166.0/256.0, 124.0/256.0, 54.0/256.0)
wood_dark = pge.rgb (76.0/256.0, 47.0/256.0, 0.0)
red = pge.rgb (1.0, 0.0, 0.0)
ball_size = 0.05
boarder = 0.01
```

Simple example

tinypge.py

```
def myquit (e):
    print ``goodbye''
    sys.exit (0)

def key_pressed (e):
    if e.key == K_ESCAPE:
        myquit (e)

def placeBoarders (thickness, color):
    print ``placeBoarders''
    floor = pge.box (0.0, 0.0, 1.0, thickness, color).fix ()
    left = pge.box (0.0, 0.0, thickness, 1.0, color).fix ()
    right = pge.box (1.0-thickness, 0.0, thickness, 1.0, color).fix ()
    top = pge.box (0.0, 1.0-thickness, 1.0, thickness, color).fix ()
    return floor, left, right, top
```

Simple example

tinypge.py

```
def main ():
    pge.slow_down (6.0)  # slows down real time by a factor of
    top, left, right, top = placeBoarders (boarder, wood_dark)
    pge.circle (0.6, 0.7, ball_size, red).mass (1.0)

    print ``before run''
    pge.gravity ()
    pge.draw_collision (True, False)
    pge.register_handler (myquit, [QUIT])
    pge.register_handler (key_pressed, [KEYDOWN])
    pge.display_set_mode ([800, 800])
    pge.run (10.0)
    pge.finish_record ()

print ``before main()''
main ()
```

Current limitations of PGE

- the screen must be square
  - xresolution must be the same as the yresolution
- only circles cannot be fixed

Features

- PGE can be asked to record the game
  - you can play it back again using the command line tool `pgeplayback`
  - useful if you want to debug your code
- it can generate frames at the time of impact, giving a greater sense of visual realism
- can slow down simulated time to make the game easier

Tutorial work and homework

- try out the examples in these notes and read the code
  - comment each line of code and read the documentation ⟨`http://floppsie.comp.glam.ac.uk/Glamorgan/gaius/pge/homepage.html`⟩ to PGE aid your understanding

Balls bouncing ramps example

marblepge.py

```
#!/usr/bin/env python

import pge, sys
from pygame.locals import *

print ``starting pge''
# pge.batch ()
pge.interactive ()
```

Balls bouncing ramps example

marblepge.py

```
t = pge.rgb (1.0/2.0, 2.0/3.0, 3.0/4.0)
wood_light = pge.rgb (166.0/256.0, 124.0/256.0, 54.0/256.0)
wood_dark = pge.rgb (76.0/256.0, 47.0/256.0, 0.0)
red = pge.rgb (1.0, 0.0, 0.0)
green = pge.rgb (0.0, 1.0, 0.0)
blue = pge.rgb (0.0, 0.0, 1.0)
blue_dark = pge.rgb (0.1, 0.1, 0.8)
steel = pge.rgb (0.5, 0.5, 0.5)
copper = pge.rgb (0.5, 0.3, 0.2)
gold = pge.rgb (0.8, 0.6, 0.15)
```

Balls bouncing ramps example

marblepge.py

```
ball_size = 0.02
boarder = 0.01
white = pge.rgb (1.0, 1.0, 1.0)
gap = 0.01
captured = None
sides = []
seconds_left = 120
previous = None
```

Balls bouncing ramps example

marblepge.py

```
def myquit (e):
    print ``goodbye''
    sys.exit (0)

def key_pressed (e):
    if e.key == K_ESCAPE:
        myquit (e)

def delete_ball (o, e):
    for b in e.collision_between ():
        if b != o:
            b.rm ()
            new_barrel ()
```

Balls bouncing ramps example

marblepge.py

```
def placeBoarders (thickness, color):
    print ``placeBoarders''
    floor = pge.box (0.0, 0.0, 1.0, thickness, color).fix ().on_collision (delete_ball)
    e2 = pge.box (0.0, 0.0, thickness, 1.0, color).fix ()
    e3 = pge.box (1.0-thickness, 0.0, thickness, 1.0, color).fix ()
    e4 = pge.box (0.0, 1.0-thickness, 1.0, thickness, color).fix ()
    return floor, e2, e3, e4
```

Balls bouncing ramps example

marblepge.py

```
def placeRamps ():
    bot = pge.poly4 (0.95, 0.2,
                     0.15, 0.18,
                     0.15, 0.17,
                     0.95, 0.19, wood_dark).fix ()
    mid = pge.poly4 (0.85, 0.4,
                     0.05, 0.42,
                     0.05, 0.43,
                     0.85, 0.41, wood_dark).fix ()
    top = pge.poly4 (0.95, 0.7,
                     0.15, 0.68,
                     0.15, 0.67,
                     0.95, 0.69, wood_dark).fix ()
```

Balls bouncing ramps example

marblepge.py

```
def timer (e = None, param = None):
    global seconds_left, previous
    if seconds_left >= 0:
        pge.at_time (1.0, timer)
        s = ``%d'' % seconds_left
        if previous != None:
            previous.rm ()
        previous = pge.text (0.8, 0.9, s, white, 100, 1)
        seconds_left -= 1
```

Balls bouncing ramps example

marblepge.py

```
def new_barrel (e = None, param = None):
    global gb
    gb = pge.circle (0.9, 0.85, 0.03, steel).mass (1.25)
```

Balls bouncing ramps example

marblepge.py

```
def main ():
    global gb, sides

    placeRamps ()
    pge.slow_down (6.0)  # slows down real time by a factor of
    timer ()
    new_barrel ()
    b1, b2, b3, b4 = placeBoarders (boarder, wood_dark)

    print ``before run''
    pge.gravity ()
    pge.draw_collision (False, False)
    pge.register_handler (myquit, [QUIT])
    pge.register_handler (key_pressed, [KEYDOWN])
    pge.display_set_mode ([800, 800])
    pge.run (seconds_left/6.0+4.0)
    pge.finish_record ()
```

Balls bouncing ramps example

marblepge.py

```
print ``before main()''
main ()
```