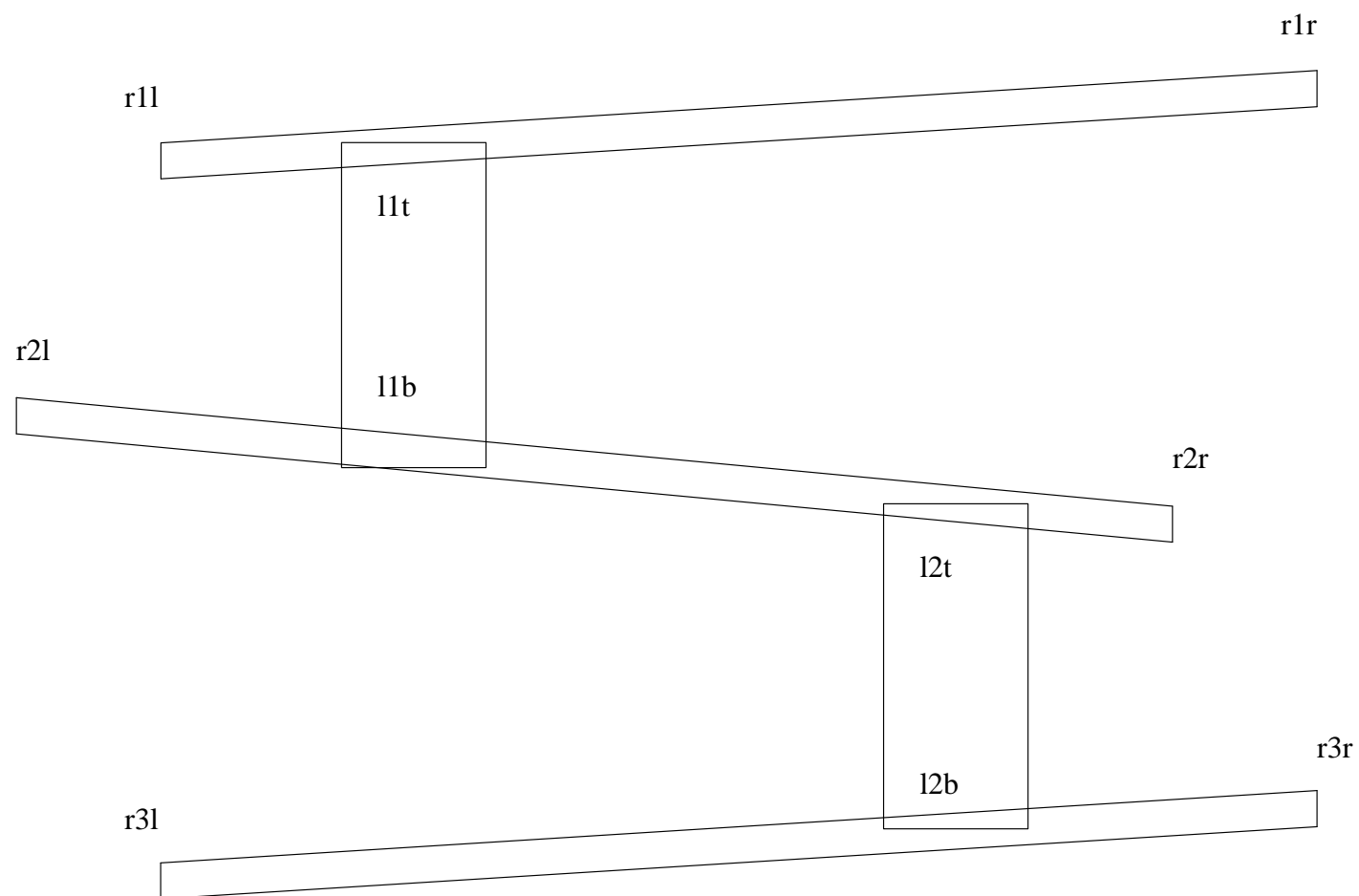


Moving barrel down ramps



Moving barrel down ramps

- create waypoints for the barrels
 - place waypoints into a dictionary (called `points`)
 - these will be screen coordinates - which we can extract from the ladder or ramp polygons

- then the barrels can use Bresenham's line algorithm to move between the waypoints

Moving barrel down ramps

- now we need a function to create a route

Moving barrel down ramps

kongroute.py

```
#!/usr/bin/python

import random

#
# the points are:  l1t, l1b, l2t, l2b    (ladder no. top and bottom)
#                  r1l, r1r            (ramp 1 left and right)
#                  r2l, r2r            (ramp 2 left and right)
#                  r3l, r3r            (ramp 3 left and right)
#
#
# a barrel might go to the end of a ramp or occasionally to
# a ladder returns a list of way points
#
```

Moving barrel down ramps

```
def gen_route ():  
    # moving along top ramp 1  
    route = ["r1r"]  
    if random.random () < 0.2:  
        route += ["l1t", "l1b"] # choose ladder  
    else:  
        route += ["r1l", "r2l"] # fall off end  
    # moving along top ramp 2  
    if random.random () < 0.2:  
        route += ["l2t", "l2b"]  
    else:  
        route += ["r2r", "r3r"]  
    # and move along ramp 3  
    route += ["r3l"]  
    return route  
  
for b in range (7):  
    print gen_route ()
```

Moving barrel down ramps

```
$ python kongroute.py  
['r1r', 'r1l', 'r2l', 'l2t', 'l2b', 'r3l']  
['r1r', 'r1l', 'r2l', 'r2r', 'r3r', 'r3l']  
['r1r', 'r1l', 'r2l', 'r2r', 'r3r', 'r3l']  
['r1r', 'r1l', 'r2l', 'l2t', 'l2b', 'r3l']  
['r1r', 'r1l', 'r2l', 'r2r', 'r3r', 'r3l']  
['r1r', 'l1t', 'l1b', 'r2r', 'r3r', 'r3l']  
['r1r', 'r1l', 'r2l', 'r2r', 'r3r', 'r3l']
```

- we can see random routes are chosen
- both ladder 1 and ladder 2 are rejected and chosen
- the function/method `random.random()` returns a floating point number in the range 0.0 to 1.0

Main function

```
def main ():  
    global screen  
    pygame.init ()  
    screen = pygame.display.set_mode ([width, height])  
    draw_scene (gradient)  
    play_game (screen)  
    wait_for_event ()  
  
main ()
```

play_game

```
def play_game (screen):  
    o = -1  
    while True:  
        t = pygame.time.get_ticks()  
        if o != t:  
            activity_scheduler (t)  
            o = t  
        checkInput()  
        screen.fill([0, 0, 0]) # blank the screen.  
        draw_polygons ()  
        for b in barrels:  
            b.update (t, 0, width)  
            screen.blit (b.image, b.rect)  
        pygame.display.flip ()
```


Points of interest

- `pygame.time.get_ticks()` returns the time in the number of milliseconds
- `screen.fill([0, 0, 0])` blank out complete screen
 - then redraw everything
- `barrels` is a list of barrels
 - when a barrel is deleted it is removed from this list

activity_scheduler

```
# there are 1000 ticks per second in pygame
activity_list = [[2000, 0.5, create_new_barrel],
                 [1000, 1.0, display_time],
                 [120000, 1.0, finish_game]]

def activity_scheduler (ticks):
    global activity_list
    for e in activity_list:
        if (ticks % e[0] == 0) and (random.random () <= e[1]):
            e[2] (ticks)
```

activity_scheduler

- describes a way of encoding when a function should be executed
- in the example above we attempt to call `create_new_barrel` every 2 seconds
 - but the program only calls this function if `random.random()` is ≥ 0.5
 - giving a probability of $\frac{1}{2}$

activity_scheduler

- the `activity_list` specifies that `display_time` is called every second
- `finish_game` is called in 2 minutes
- notice that it is possible that `finish_game` might not be called!
 - the call to `pygame.time.get_ticks()` might miss this tick (due to the operating system running something else)

activity_scheduler

- this approach is very useful as it allows for easy experimentation
- it also allows the program to change the rate or probability depending upon circumstance

check_input

```
def checkInput():
    for event in pygame.event.get():
        if event.type == KEYDOWN:
            if event.key == K_ESCAPE:
                sys.exit(0)
            elif event.key == K_RIGHT:
                print "right cursor pressed"
                # do_right
            elif event.key == K_LEFT:
                print "left cursor pressed"
                # do left
            elif event.key == K_UP:
                print "up cursor pressed"
                # do_jump
```

check_input

- the above are placeholders to make Mario jump or move

Barrel sprites

```
class barrel_sprite (pygame.sprite.Sprite):
    image = None

    def __init__ (self):
        pygame.sprite.Sprite.__init__(self)
        if barrel_sprite.image is None:
            barrel_sprite.image = pygame.image.load ("barrel.png").convert ()
        self.image = barrel_sprite.image
        self.radius = barrel_sprite.image.get_height()
        self.rect = self.image.get_rect()
        self.route = gen_route ()
        self.rect.topleft = points[self.route[0]]
        self.next_update_time = 0 # update() hasn't been called yet.
        self.nav = None
        self.hop_goal = 0
```


Barrel sprites

- `points` is a dictionary of our way points
 - `points["l1t"]` gives a coordinate (list) of an x and y value for the top of ladder 1
- `gen_route()` returns the random route list which we covered in the earlier slides
- `self.nav` will contain the Bresenham's object which is instantiated when we call `p2pnav.walk_along` (seen in the next slide)
- `self.goal` determines which waypoint this barrel is moving towards
- `self.rect.topleft = points[self.route[0]]` assigns the initial position to this sprite

Barrel sprites

```
def update (self, current_time, left, right):
    global barrels
    # Update every 10 milliseconds = 1/100th of a second.
    if self.next_update_time < current_time:
        if self.nav == None or self.nav.finished ():
            if self.hop_goal == len (self.route)-1:
                # finished all routes, delete ourself
                self.kill ()
                barrels.remove (self)
            else:
                # move onto next route
                self.nav = p2pnav.walk_along (self.get_point (self.hop_goal),
                                                self.get_point (self.hop_goal+1))
                self.hop_goal += 1
        self.rect.topleft = self.nav.get_next ()
        self.next_update_time = current_time + 10
```

get_point

- the method `get_point` is needed to adjust the waypoints slightly to take into account the barrel image size
- left points need to be adjusted leftwards so that the barrels fall off the edge rather than drop through the floor
- the ladder bottom point needs adjusting updates so that the barrel rests on the floor
- the ramp height is adjusted so that the barrel appears to roll along the ramp
- it is better to adjust the values in this method as it takes into consideration the sprite image size

get_point

```
def get_point (self, goal):
    if self.route[goal][-1] == 'b':
        # bottom of the ladder is adjusted upwards
        return [points[self.route[goal]][0],
                points[self.route[goal]][1]-self.radius]
    elif self.route[goal][-1] == 'l':
        # left ramp way point is adjusted, so it falls off edge
        x = points[self.route[goal]][0]-self.radius/2
    elif self.route[goal][-1] == 'r':
        # right ramp way point is adjusted, so it falls off edge
        x = points[self.route[goal]][0]-self.radius/2
    else:
        x = points[self.route[goal]][0]
    # we do adjust the ramp height, to offset the circle height
    return x, points[self.route[goal]][1]-self.radius/2
```

Homework/tutorial work

- download this code and study it
- comment each function/method/class
- change the code so that you have
 - smaller barrels
 - more ramps and more ladders
- consider how you might introduce Mario as a sprite

Homework/tutorial work

```
#!/usr/bin/python

import pygame, sys, time, random, bres
from pygame.locals import *

ramp_one, ramp_two, ramp_three = None, None, None

wood_light = (166, 124, 54)
wood_dark = (76, 47, 0)
blue = (0, 100, 255)
dark_red = (166, 25, 50)
dark_green = (25, 100, 50)
dark_blue = (25, 50, 150)
black = (0, 0, 0)
white = (255, 255, 255)
ladder_colour = (58, 112, 106)
```

Homework/tutorial work

```
width, height = 1024, 768  
screen = None  
ramp_height = 0.03  
ramp_length = 0.85  
ladder_height = 0.3  
ladder_length = 0.07  
gradient = 32  
points = {}  
debugging = False  
barrels = []
```

Homework/tutorial work

```
#  
# the points are:  l1t, l1b, l2t, l2b    (ladder no. top and bottom)  
#                  r1l, r1r              (ramp 1 left and right)  
#                  r2l, r2r              (ramp 2 left and right)  
#                  r3l, r3r              (ramp 3 left and right)  
#  
  
#  
# a barrel might go to the end of a ramp or occasionally to a ladder  
# returns a list of way points  
#
```


Homework/tutorial work

```
def gen_route ():  
    # moving along top ramp 1  
    route = ["r1r"]  
    if random.random () < 0.2:  
        route += ["l1t", "l1b"] # choose ladder  
    else:  
        route += ["r1l", "r2l"] # fall off end  
    # moving along top ramp 2  
    if random.random () < 0.2:  
        route += ["l2t", "l2b"]  
    else:  
        route += ["r2r", "r3r"]  
    # and move along ramp 3  
    route += ["r3l"]  
    return route
```

Homework/tutorial work

```
class barrel_sprite (pygame.sprite.Sprite):
    image = None

    def __init__ (self):
        pygame.sprite.Sprite.__init__(self)
        if barrel_sprite.image is None:
            barrel_sprite.image = pygame.image.load ("barrel.png").convert ()
        self.image = barrel_sprite.image
        self.radius = barrel_sprite.image.get_height()
        self.rect = self.image.get_rect()
        self.route = gen_route ()
        self.rect.topleft = points[self.route[0]]
        self.next_update_time = 0 # update() hasnt been called yet.
        self.nav = None
        self.hop_goal = 0
```

Homework/tutorial work

```
def update (self, current_time, left, right):
    global barrels
    # Update every 10 milliseconds = 1/100th of a second.
    if self.next_update_time < current_time:
        if self.nav == None or self.nav.finished ():
            if self.hop_goal == len (self.route)-1:
                # finished all routes, delete ourself
                self.kill ()
                barrels.remove (self)
            else:
                # move onto next route
                self.nav = bres.walk_along (self.get_point (self.hop_goal),
                                            self.get_point (self.hop_goal+1))

                self.hop_goal += 1
        self.rect.topleft = self.nav.get_next ()
        self.next_update_time = current_time + 10
```

Homework/tutorial work

```
def get_point (self, goal):
    if self.route[goal][-1] == "b":
        # bottom of the ladder is adjusted upwards
        return [points[self.route[goal]][0],
                points[self.route[goal]][1]-self.radius]
    elif self.route[goal][-1] == "l":
        # left ramp way point is adjusted, so it falls off edge
        x = points[self.route[goal]][0]-self.radius/2
    elif self.route[goal][-1] == "r":
        # right ramp way point is adjusted, so it falls off edge
        x = points[self.route[goal]][0]-self.radius/2
    else:
        x = points[self.route[goal]][0]
    # we do adjust the ramp height, to offset the circle height
    return x, points[self.route[goal]][1]-self.radius/2
```

Homework/tutorial work

```
def xpos (v):
    global height
    return (int) (width*v)

def ypos (v):
    global width
    return (int) (height*v)

def draw_ramp (xoffset, yoffset, left_drop, right_drop):
    global ramp_length, ramp_height
    top_left = [xpos (xoffset), ypos (yoffset)+left_drop]
    top_right = [xpos (xoffset+ramp_length), ypos (yoffset)+right_drop]
    bot_right = [xpos (xoffset+ramp_length), ypos (yoffset+ramp_height)+right_drop]
    bot_left = [xpos (xoffset), ypos (yoffset+ramp_height)+left_drop]
    return pygame.draw.polygon (screen, wood_dark, [top_left, top_right, bot_right, bot
```

Homework/tutorial work

```
def draw_ramps (drop):  
    return [draw_ramp (0.1, 0.16, drop, 0),  
            draw_ramp (0.03, 0.48, 0, drop),  
            draw_ramp (0.1, 0.80, drop, 0)]  
  
def wait_for_event ():  
    while True:  
        event = pygame.event.wait()  
        if event.type == pygame.QUIT:  
            sys.exit(0)  
        if event.type == KEYDOWN:  
            if event.key == K_ESCAPE:  
                sys.exit (0)
```

Homework/tutorial work

```
def add_points (ladders, ramps, gradient):
    global points
    for i, l in enumerate (ladders):
        top = "l%dt" % (i+1)
        bot = "l%db" % (i+1)
        print top, bot
        points[top] = [l.left, l.top-ypos (.045)]
        points[bot] = [l.left, l.bottom-ypos (.019)]
    for i, l in enumerate (ramps):
        left = "r%dl" % (i+1)
        right = "r%dr" % (i+1)
        print left, right
        if i % 2 == 0:
            points[left] = [l.left, l.top]
            points[right] = [l.right, l.top-gradient]
        else:
            points[left] = [l.left, l.top-gradient]
            points[right] = [l.right, l.top]
```

Homework/tutorial work

```
def draw_scene (gradient):  
    global list_of_polygons  
    for i in range (gradient):  
        draw_ramps (i)  
        pygame.display.flip ()  
        screen.fill (black)  
        if not debugging:  
            time.sleep (.2)  
    l = draw_ladders (gradient)  
    r = draw_ramps (gradient)  
    list_of_polygons = l + r  
    pygame.display.flip ()  
    add_points (l, r, gradient)  
    print points
```


Homework/tutorial work

```
def draw_ladder (x, y, drop):  
    global ladder_length, ladder_height  
    top_left = [xpos (x), ypos (y)+drop]  
    top_right = [xpos (x+ladder_length), ypos (y)+drop]  
    bot_right = [xpos (x+ladder_length), ypos (y+ladder_height)+drop]  
    bot_left = [xpos (x), ypos (y+ladder_height)+drop]  
    return pygame.draw.polygon (screen, ladder_colour, [top_left, top_right, bot_right,  
  
def draw_ladders (drop):  
    return [draw_ladder (0.2, 0.16, drop),  
            draw_ladder (0.7, 0.48, drop)]
```

Homework/tutorial work

```
def activity_scheduler (ticks):
    global activity_list
    for e in activity_list:
        if (ticks % e[0] == 0) and (random.random () <= e[1]):
            e[2] (ticks)

def create_new_barrel (ticks):
    global barrels
    barrels += [barrel_sprite ()]

def display_time (ticks):
    print "time is", ticks/100
    pass
```

Homework/tutorial work

```
def finish_game (ticks):  
    print "game over"  
    sys.exit (0)  
  
# there are 1000 ticks per second in pygame  
activity_list = [[2000, 0.5, create_new_barrel],  
                 [1000, 1.0, display_time],  
                 [120000, 1.0, finish_game]]
```

Homework/tutorial work

```
def checkInput():  
    for event in pygame.event.get():  
        if event.type == KEYDOWN:  
            if event.key == K_ESCAPE:  
                sys.exit(0)  
            elif event.key == K_RIGHT:  
                print "right cursor pressed"  
                # do_right  
            elif event.key == K_LEFT:  
                print "left cursor pressed"  
                # do left  
            elif event.key == K_UP:  
                print "up cursor pressed"  
                # do_jump
```

Homework/tutorial work

```
def draw_polygons ():
    draw_ladders (gradient)
    draw_ramps (gradient)

def play_game (screen):
    o = -1
    while True:
        t = pygame.time.get_ticks()
        if o != t:
            activity_scheduler (t)
            o = t
        checkInput()
        screen.fill([0, 0, 0]) # blank the screen.
        draw_polygons ()
        for b in barrels:
            b.update (t, 0, width)
            screen.blit (b.image, b.rect)
        # pygame.display.update()
        pygame.display.flip ()
```

Homework/tutorial work

```
def main ():  
    global screen  
    pygame.init ()  
    screen = pygame.display.set_mode ([width, height])  
    draw_scene (gradient)  
    play_game (screen)  
    wait_for_event ()  
  
main ()
```

barrel image

- here is the very simple image used to test the above code
⟨[barrel.png](#)⟩
- the module `bres.py` can be found at the end of the previous weeks notes
 - it needs to present in the same directory as the file above
 - together with the ⟨[barrel.png](#)⟩ file