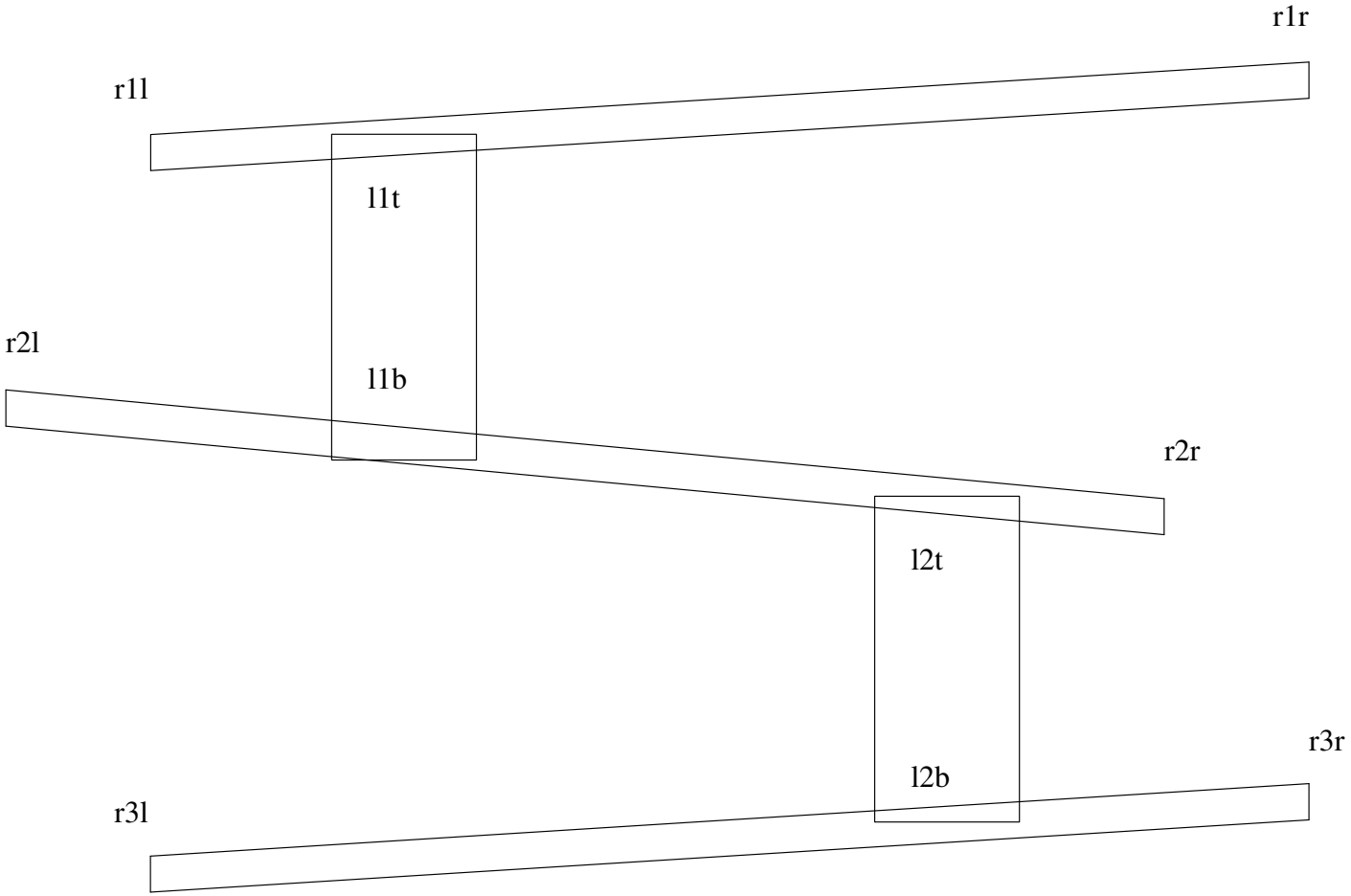
Moving barrel down ramps



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/env python3

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

```
$ python3 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 compete 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 side)

- `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 though 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/env python3

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