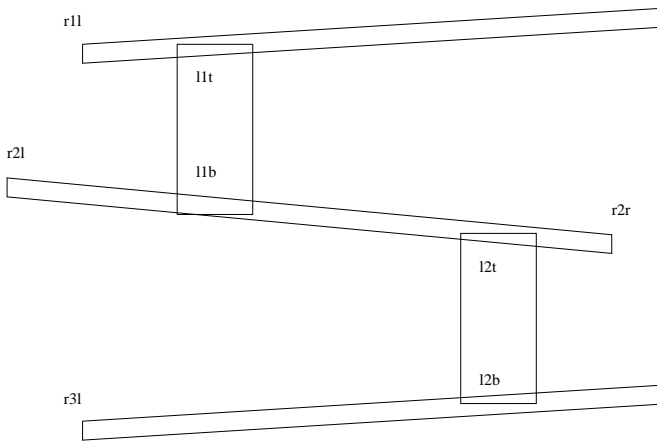


## Moving barrel down ramps



- 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: 11t, 11b, 12t, 12b (ladder no. top
#                   r1l, r1r          (ramp 1 left and
#                   r2l, r2r          (ramp 2 left and
#                   r3l, r3r          (ramp 3 left and
#
#
# a barrel might go to the end of a ramp or occasionally
# 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  $\geq 0.5$
  - 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")
        self.image = barrel_sprite.image
        self.radius = barrel_sprite.image.get_height() / 2
        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
        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 ourselves
                self.kill()
                barrels.remove(self)
            else:
                # move onto next route
                self.nav = p2pnav.walk_along(self.goal, self.ge
                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
        x = points[self.route[goal]][0]-self.radius/2
    elif self.route[goal][-1] == 'r':
        # right ramp way point is adjusted, so it falls
        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
    return x, points[self.route[goal]][1]-self.radius
```

**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: 11t, 11b, 12t, 12b (ladder no. top
#                   r1l, r1r (ramp 1 left and
#                   r2l, r2r (ramp 2 left and
#                   r3l, r3r (ramp 3 left and
#
#
# a barrel might go to the end of a ramp or occasionally
# 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 ("bar
        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 c
        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 sec
    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_]
                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/2]
    elif self.route[goal][-1] == "l":
        # left ramp way point is adjusted, so it fall
        x = points[self.route[goal]][0]-self.radius/2
    elif self.route[goal][-1] == "r":
        # right ramp way point is adjusted, so it fal
        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 cir
    return x, points[self.route[goal]][1]-self.radius

```

**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+ramp_height)]
    bot_right = [xpos (xoffset+ramp_length), ypos (yoffset)]
    bot_left = [xpos (xoffset), ypos (yoffset+ramp_height)]
    return pygame.draw.polygon (screen, wood_dark, [top_left, top_right, bot_right, bot_left])

```

**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_h
    bot_left = [xpos (x), ypos (y+ladder_height)+drop]
    return pygame.draw.polygon (screen, ladder_colour, [t

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
            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****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 ()

```

```

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