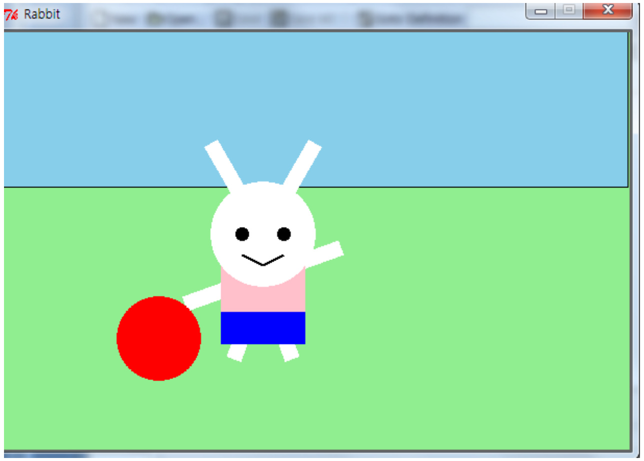
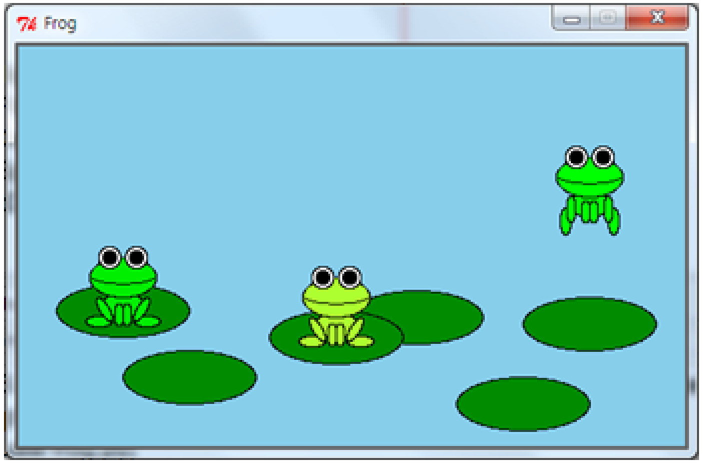
Week 5 : Create graphical display
(Practice objects and basic data types)

Today's Topic

- Pair programming
- Practice on functions with global variables
- Playing with 'cs1graphics' objects
  - Canvas
  - Drawable objects
  - Operations on drawable objects
  - Layer
  - Animation





Pair Programming

- Pair programming is a software development technique in which two programmers work together at one work station
- One types in code while the other reviews each line of code as it is typed in
- Members
  - The person typing the code is called the driver
  - The person reviewing the code is called the navigator
- Pair programming has a lot of benefits!
  - http://en.wikipedia.org/wiki/Pair_programming
- In CS101, we do pair programming on 5, 6, 9 and 10 Lab week

Pair Programming

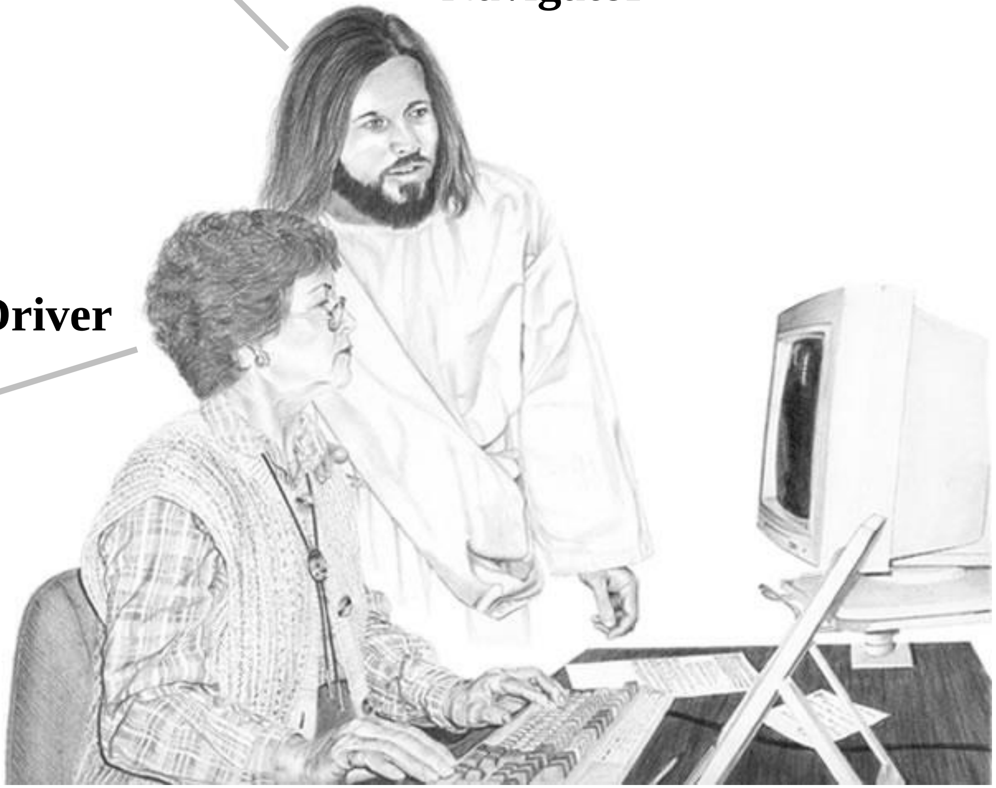
The two programmers should switch roles every **20 minutes** in CS101 class

- Do not touch the computer
- Review the code
- Think about language issues and upcoming issues related to the problem being solved

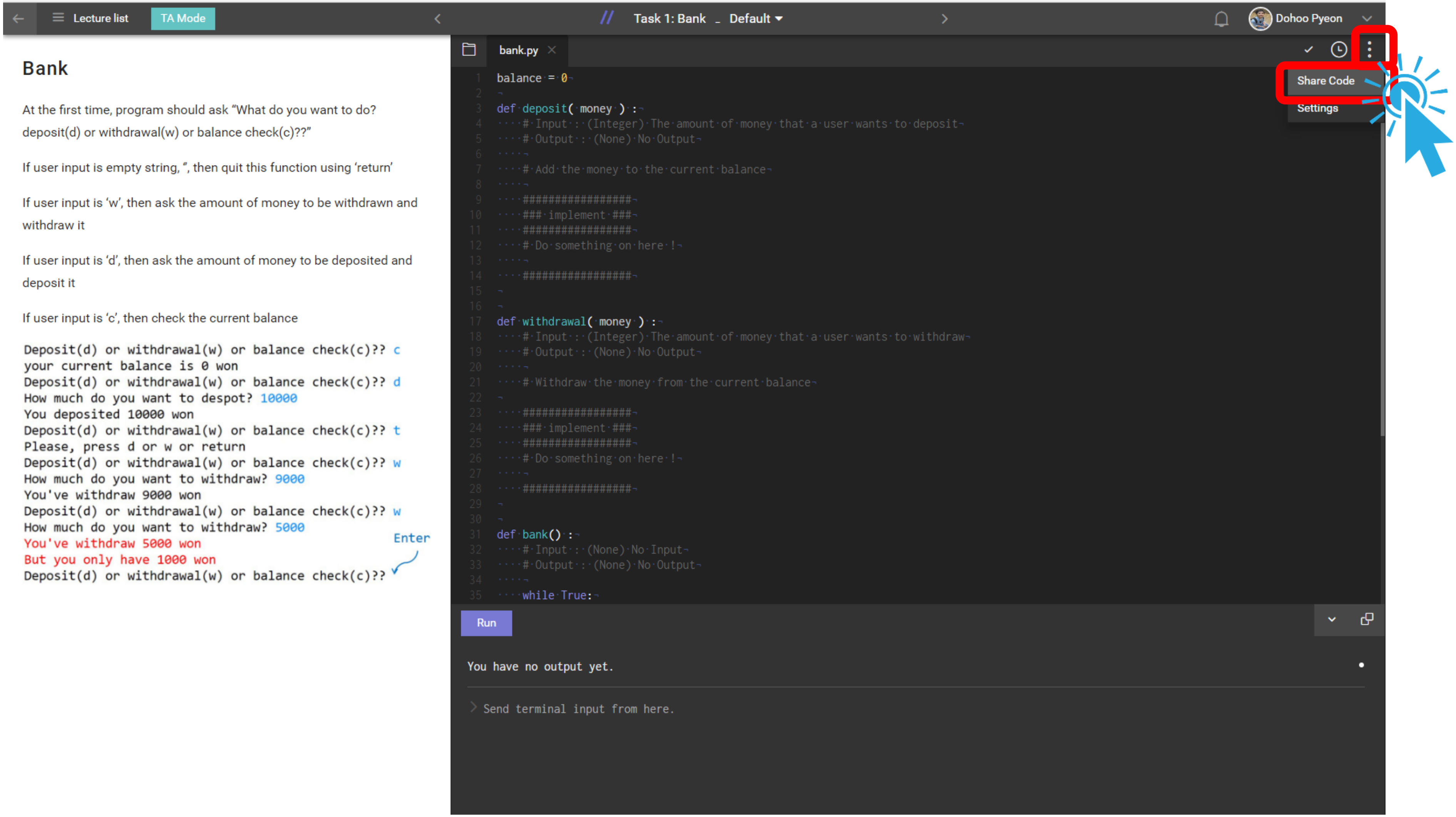
Navigator

- Work with the computer
- Focus all of his or her attention, using the navigator as a safety guide

Driver



Pair Programming Setup Steps (1)



Bank

At the first time, program should ask “What do you want to do? deposit(d) or withdrawal(w) or balance check(c)??”

If user input is empty string, ”, then quit this function using ‘return’

If user input is ‘w’, then ask the amount of money to be withdrawn and withdraw it

If user input is ‘d’, then ask the amount of money to be deposited and deposit it

If user input is ‘c’, then check the current balance

```
Deposit(d) or withdrawal(w) or balance check(c)?? c
your current balance is 0 won
Deposit(d) or withdrawal(w) or balance check(c)?? d
How much do you want to despot? 10000
You deposited 10000 won
Deposit(d) or withdrawal(w) or balance check(c)?? t
Please, press d or w or return
Deposit(d) or withdrawal(w) or balance check(c)?? w
How much do you want to withdraw? 9000
You've withdraw 9000 won
Deposit(d) or withdrawal(w) or balance check(c)?? w
How much do you want to withdraw? 5000
You've withdraw 5000 won
But you only have 1000 won
Deposit(d) or withdrawal(w) or balance check(c)??
```

Enter

```python
balance = 0

def deposit( money ) :
    # Input : (Integer) The amount of money that a user wants to deposit
    # Output : (None) No Output
    
    # Add the money to the current balance
    
    #################
    ### implement ###
    #################
    # Do something on here !
    
    #################


def withdrawal( money ) :
    # Input : (Integer) The amount of money that a user wants to withdraw
    # Output : (None) No Output
    
    # Withdraw the money from the current balance

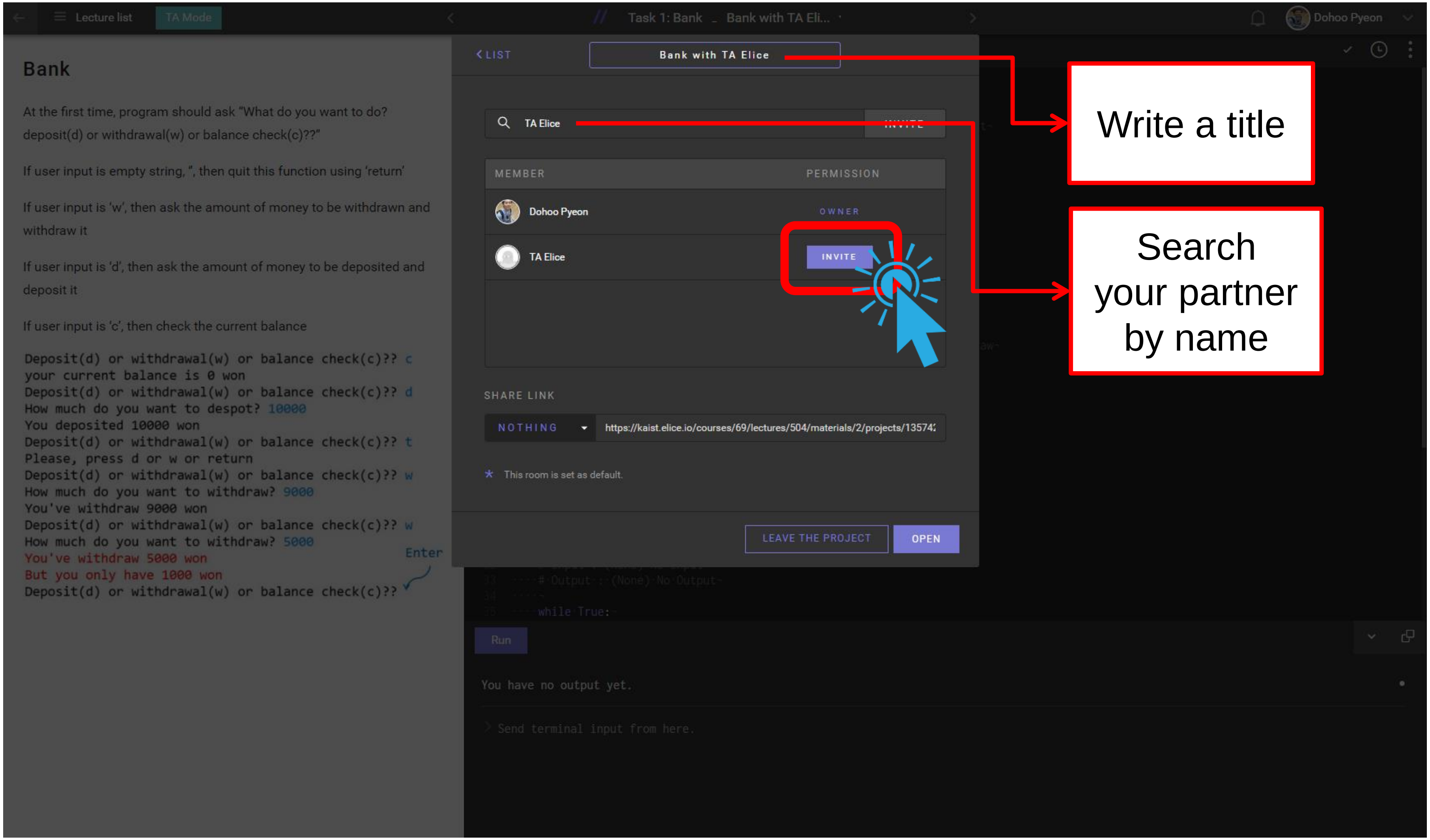
    #################
    ### implement ###
    #################
    # Do something on here !
    
    #################


def bank() :
    # Input : (None) No Input
    # Output : (None) No Output
    
    while True:
```

```
You have no output yet.

> Send terminal input from here.
```

Pair Programming Setup Steps (2)



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Please, press d or w or return
Deposit(d) or withdrawal(w) or balance check(c)?? w
How much do you want to withdraw? 9000
You've withdraw 9000 won
Deposit(d) or withdrawal(w) or balance check(c)?? w
How much do you want to withdraw? 5000
You've withdraw 5000 won
But you only have 1000 won
Deposit(d) or withdrawal(w) or balance check(c)??
```

Enter

Bank with TA Elice

TA Elice

MEMBER	PERMISSION
Dohoo Pyeon	OWNER
TA Elice	INVITE

SHARE LINK

NOTHING ▾ https://kaist.elice.io/courses/69/lectures/504/materials/2/projects/13574

★ This room is set as default.

LEAVE THE PROJECT OPEN

```
    # Output : (None) No Output

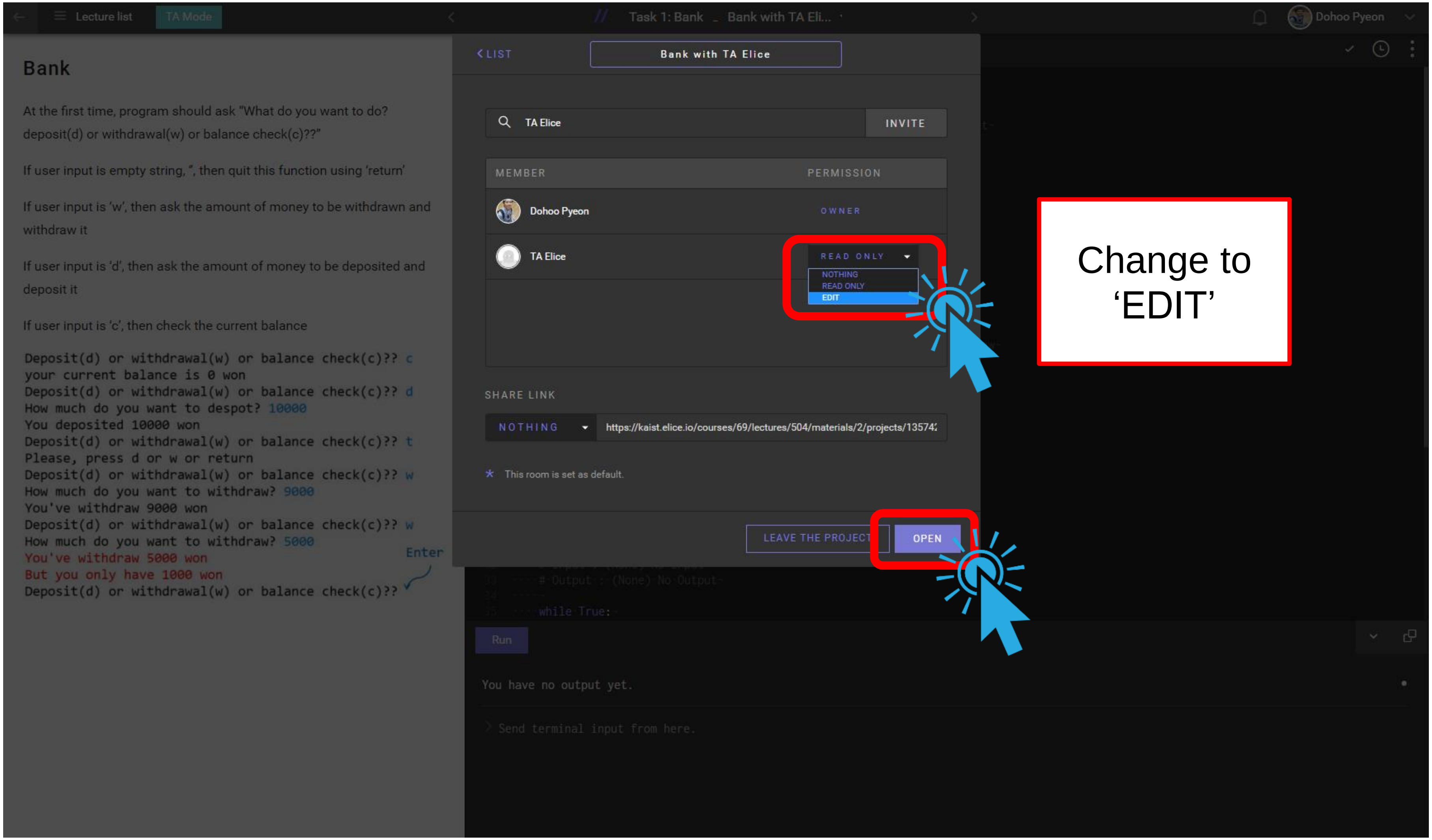
    while True:
```

```
You have no output yet.
> Send terminal input from here.
```

Write a title

Search your partner by name

Pair Programming Setup Steps (3)



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How much do you want to withdraw? 9000
You've withdraw 9000 won
Deposit(d) or withdrawal(w) or balance check(c)?? w
How much do you want to withdraw? 5000
You've withdraw 5000 won
But you only have 1000 won                          Enter
Deposit(d) or withdrawal(w) or balance check(c)??
```

TA Elice

MEMBER	PERMISSION
Dohoo Pyeon	OWNER
TA Elice	READ ONLY

SHARE LINK

NOTHING https://kaist.elice.io/courses/69/lectures/504/materials/2/projects/13574:

* This room is set as default.

```
    # Output : (None) No Output

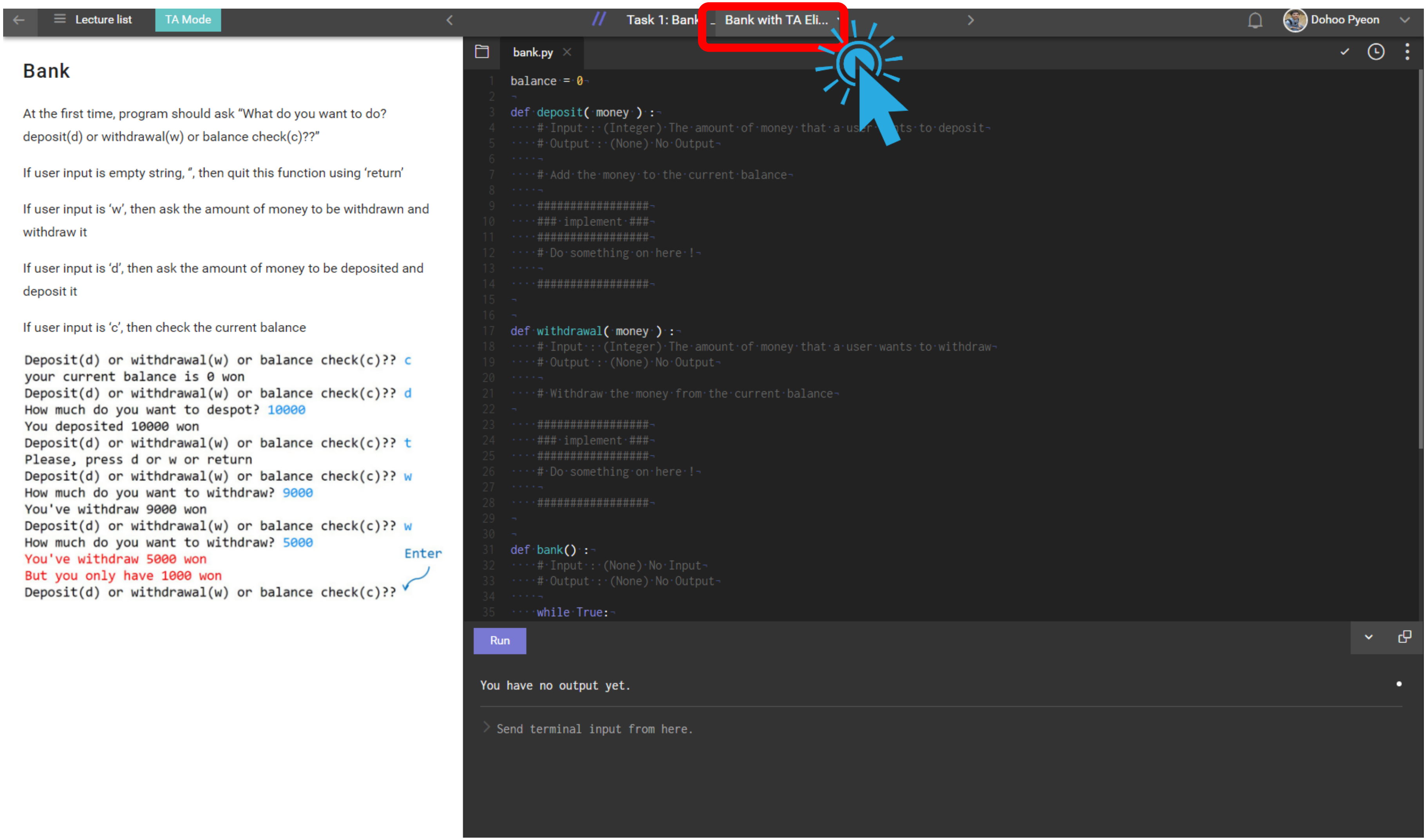
    while True:
```

```
You have no output yet.
```

> Send terminal input from here.

Change to 'EDIT'

Pair Programming Setup Steps (4)



Bank

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You've withdraw 9000 won
Deposit(d) or withdrawal(w) or balance check(c)?? w
How much do you want to withdraw? 5000
You've withdraw 5000 won
But you only have 1000 won
Deposit(d) or withdrawal(w) or balance check(c)??
```

Enter

```python
balance = 0

def deposit( money ) :
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    #################
    # Do something on here !
    
    #################


def withdrawal( money ) :
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    #################
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def bank() :
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    while True:
```

```
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> Send terminal input from here.
```
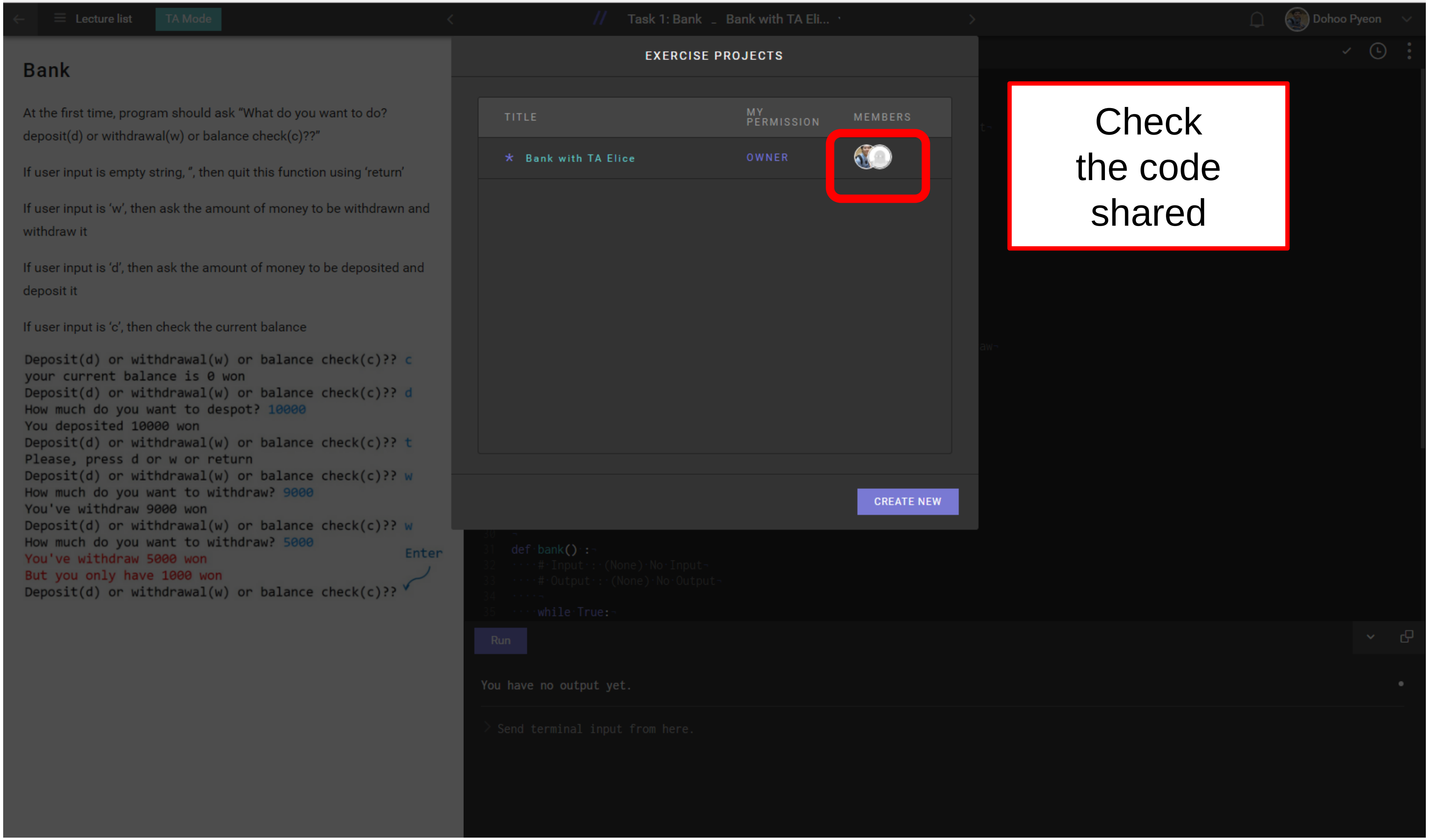

Pair Programming Setup Steps (5)



TITLE	MY PERMISSION	MEMBERS
★ Bank with TA Elice	OWNER	

Bank

At the first time, program should ask "What do you want to do? deposit(d) or withdrawal(w) or balance check(c)??"

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How much do you want to withdraw? 9000
You've withdraw 9000 won
Deposit(d) or withdrawal(w) or balance check(c)?? w
How much do you want to withdraw? 5000
You've withdraw 5000 won
But you only have 1000 won
Deposit(d) or withdrawal(w) or balance check(c)??
```

Enter

```
def bank() :
    # Input : (None) No Input
    # Output : (None) No Output

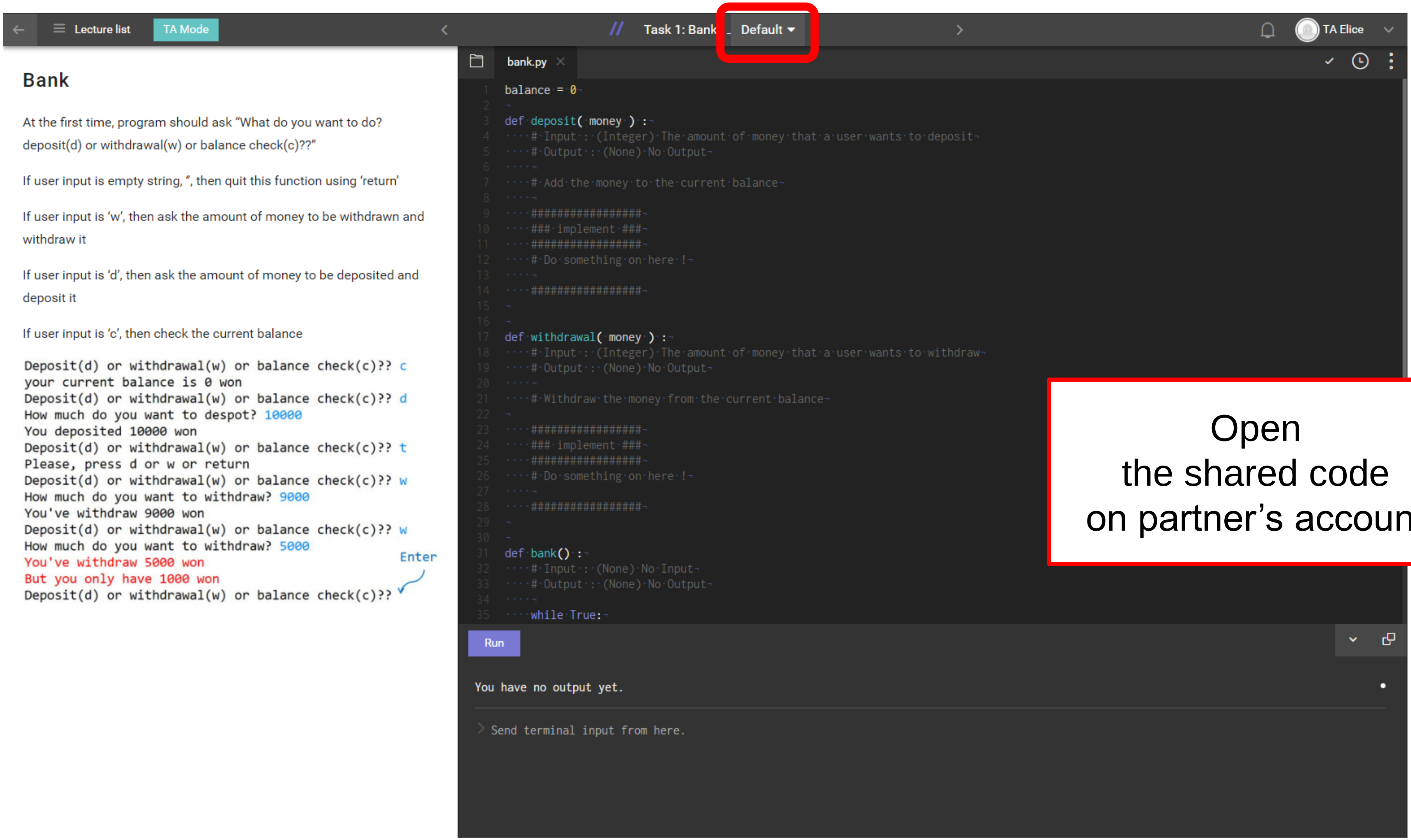
    while True:
```

```
You have no output yet.

> Send terminal input from here.
```

Check the code shared

Pair Programming Setup Steps (6)



Bank

At the first time, program should ask "What do you want to do? deposit(d) or withdrawal(w) or balance check(c)??"

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Deposit(d) or withdrawal(w) or balance check(c)?? w
How much do you want to withdraw? 9000
You've withdraw 9000 won
Deposit(d) or withdrawal(w) or balance check(c)?? w
How much do you want to withdraw? 5000
You've withdraw 5000 won
But you only have 1000 won
Deposit(d) or withdrawal(w) or balance check(c)??
```

Enter

```python
balance = 0

def deposit( money ) :
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    #################
    ### implement ###
    #################
    # Do something on here !
    
    #################


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    #################
    ### implement ###
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    while True:
```
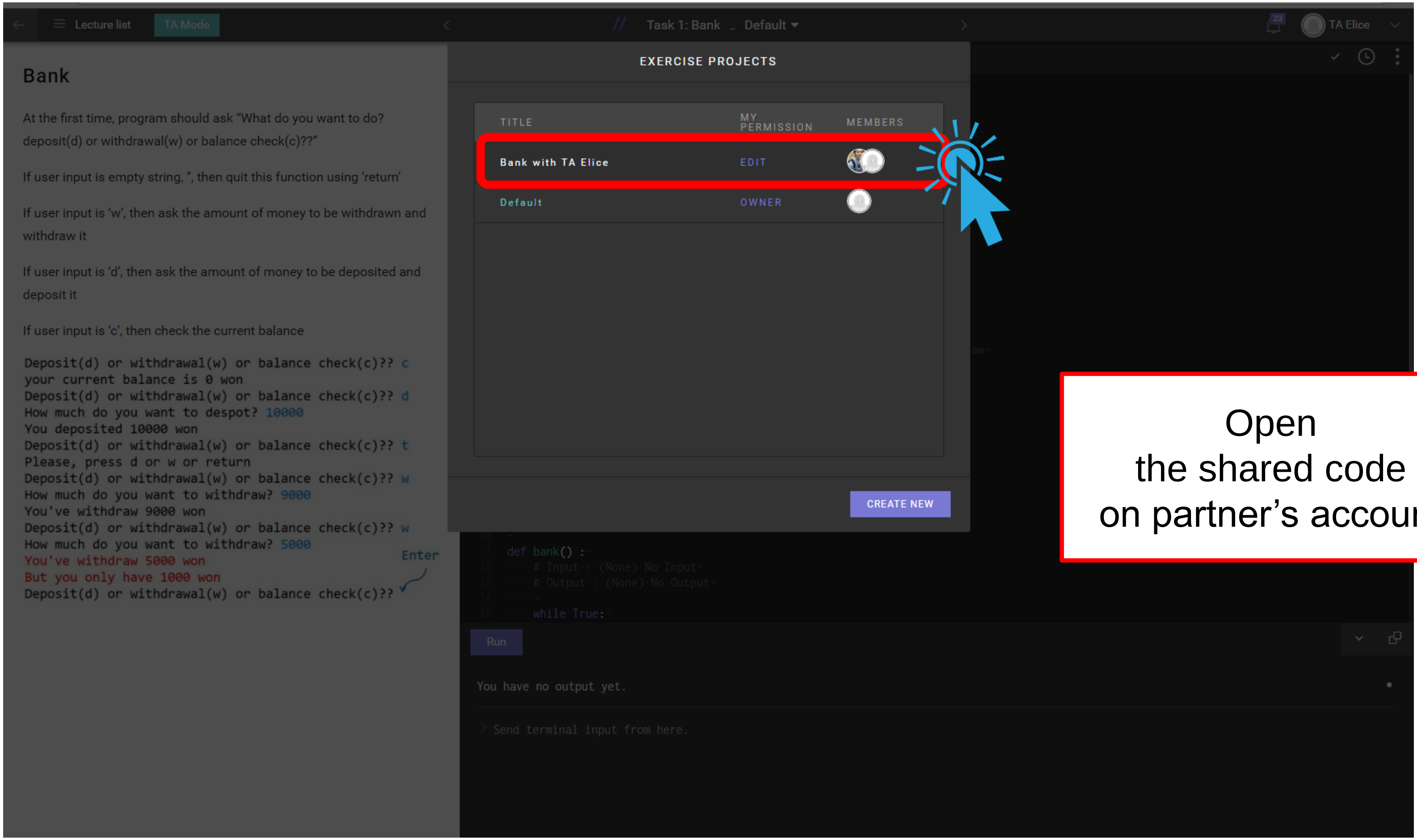

```
You have no output yet.

> Send terminal input from here.
```

Open
the shared code
on partner's account

Pair Programming Setup Steps (7)



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You've withdraw 9000 won
Deposit(d) or withdrawal(w) or balance check(c)?? w
How much do you want to withdraw? 5000
You've withdraw 5000 won
But you only have 1000 won
Deposit(d) or withdrawal(w) or balance check(c)??
```

Enter

EXERCISE PROJECTS

TITLE	MY PERMISSION	MEMBERS
Bank with TA Elice	EDIT	
Default	OWNER	

CREATE NEW

```
def bank() :
    # Input : (None) No Input
    # Output : (None) No Output

    while True:
```

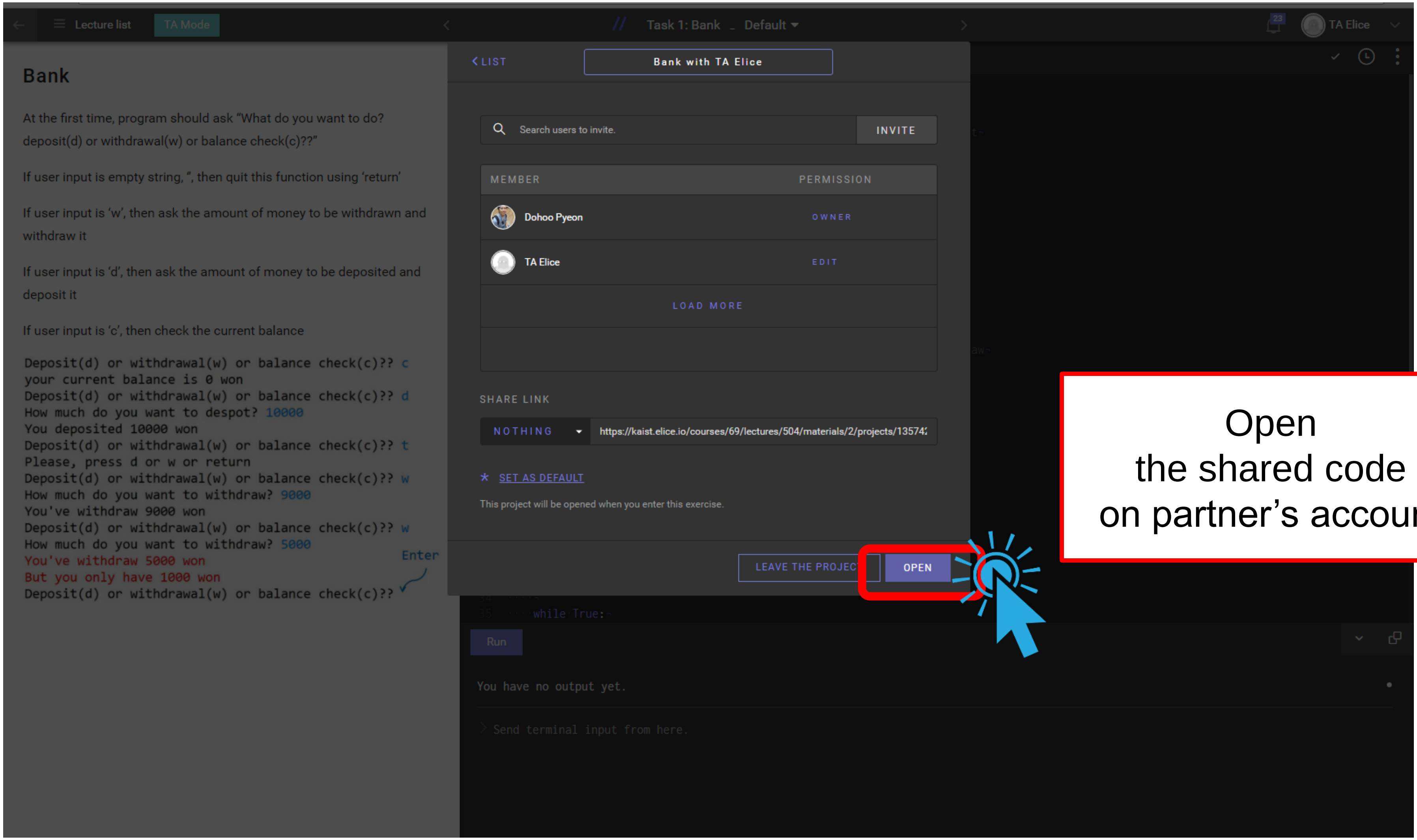
Run

```
You have no output yet.
```

> Send terminal input from here.

Open
the shared code
on partner’s account

Pair Programming Setup Steps (8)



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How much do you want to withdraw? 9000
You've withdraw 9000 won
Deposit(d) or withdrawal(w) or balance check(c)?? w
How much do you want to withdraw? 5000
You've withdraw 5000 won
But you only have 1000 won
Deposit(d) or withdrawal(w) or balance check(c)??
```

MEMBER	PERMISSION
Dohoo Pyeon	OWNER
TA Elice	EDIT

SHARE LINK

NOTHING ▾ https://kaist.elice.io/courses/69/lectures/504/materials/2/projects/13574

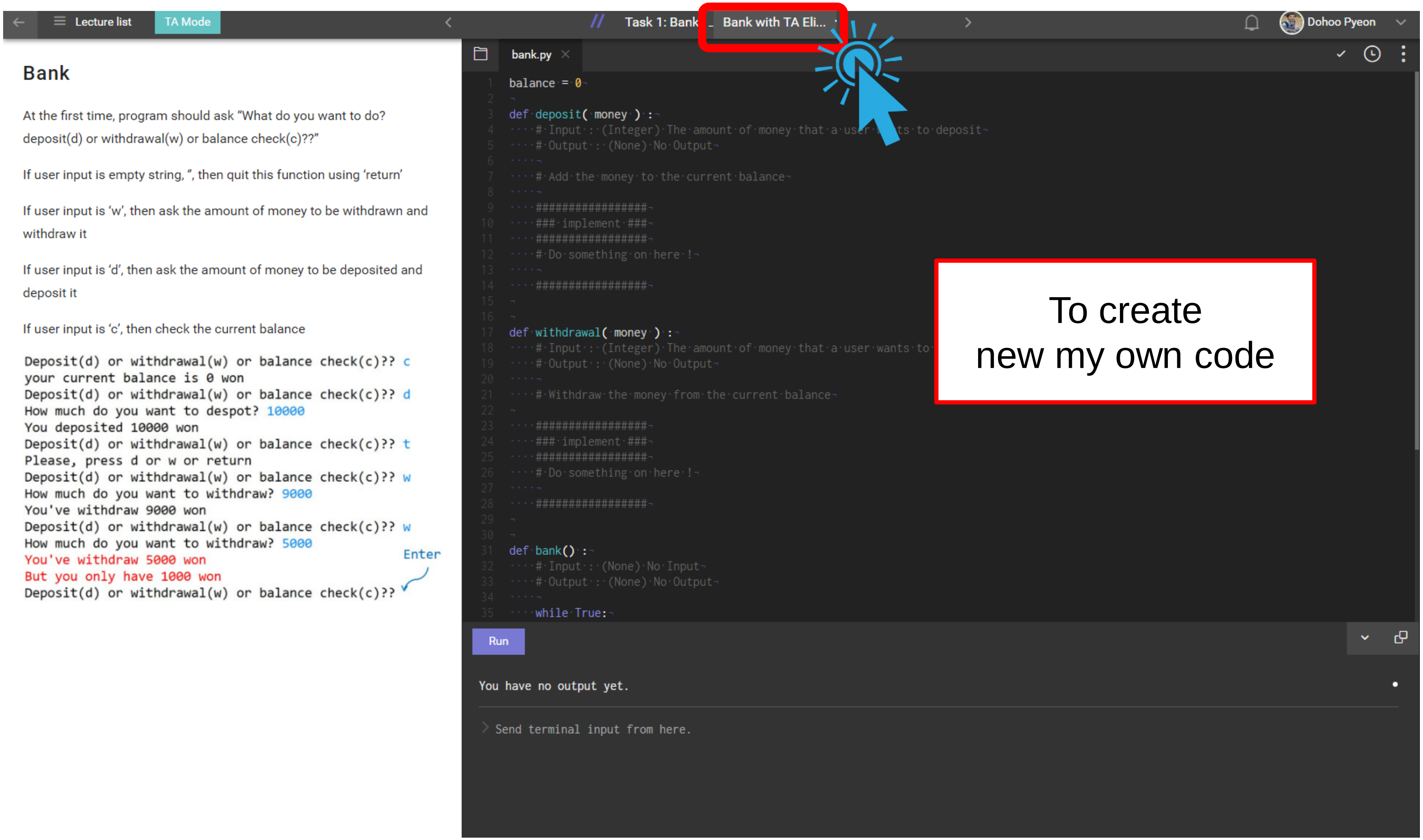
This project will be opened when you enter this exercise.

```
while True:
```

```
You have no output yet.
> Send terminal input from here.
```

Open
the shared code
on partner's account

Pair Programming Setup Steps (9)



Bank

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How much do you want to withdraw? 9000
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How much do you want to withdraw? 5000
You've withdraw 5000 won
But you only have 1000 won
Deposit(d) or withdrawal(w) or balance check(c)??
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Enter

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    # Add the money to the current balance
    
    #################
    ### implement ###
    #################
    # Do something on here !
    
    #################


def withdrawal( money ) :
    # Input : (Integer) The amount of money that a user wants to
    # Output : (None) No Output
    
    # Withdraw the money from the current balance

    #################
    ### implement ###
    #################
    # Do something on here !
    
    #################

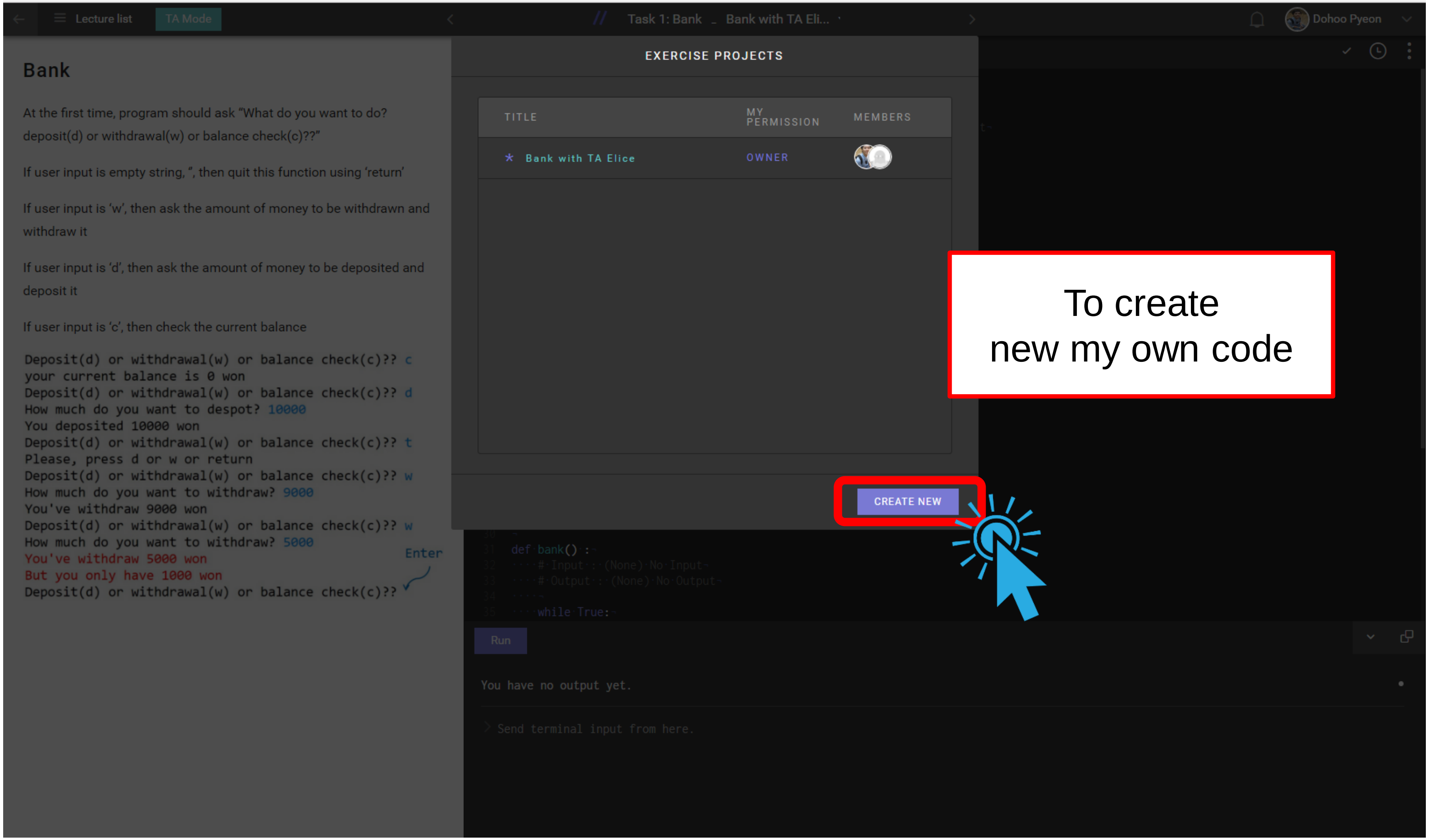

def bank() :
    # Input : (None) No Input
    # Output : (None) No Output
    
    while True:
```

```
You have no output yet.

> Send terminal input from here.
```

To create new my own code

Pair Programming Setup Steps (10)



Bank

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You've withdraw 5000 won
But you only have 1000 won
Deposit(d) or withdrawal(w) or balance check(c)??
```

TITLE	MY PERMISSION	MEMBERS
★ Bank with TA Elice	OWNER	

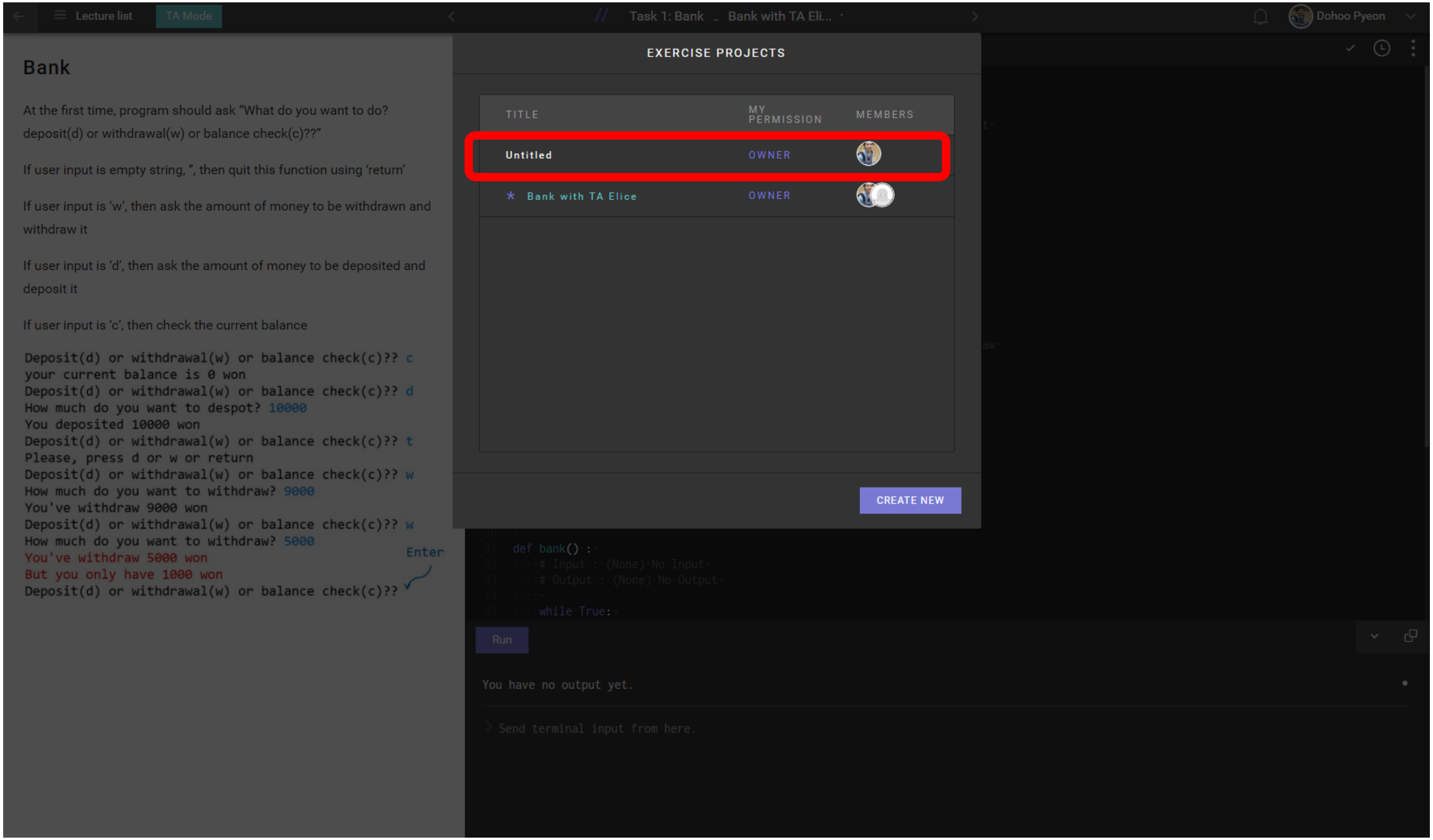
```
def bank() :
    # Input : (None) No Input
    # Output : (None) No Output

    while True:
```

```
You have no output yet.
> Send terminal input from here.
```

To create
new my own code

Pair Programming Setup Steps (11)



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How much do you want to withdraw? 5000
You've withdraw 5000 won
But you only have 1000 won
Deposit(d) or withdrawal(w) or balance check(c)??
```

Enter

EXERCISE PROJECTS

TITLE	MY PERMISSION	MEMBERS
Untitled	OWNER	
★ Bank with TA Elice	OWNER	

CREATE NEW

```
def bank() :
    # Input : (None) No Input
    # Output : (None) No Output
    
    while True:
```

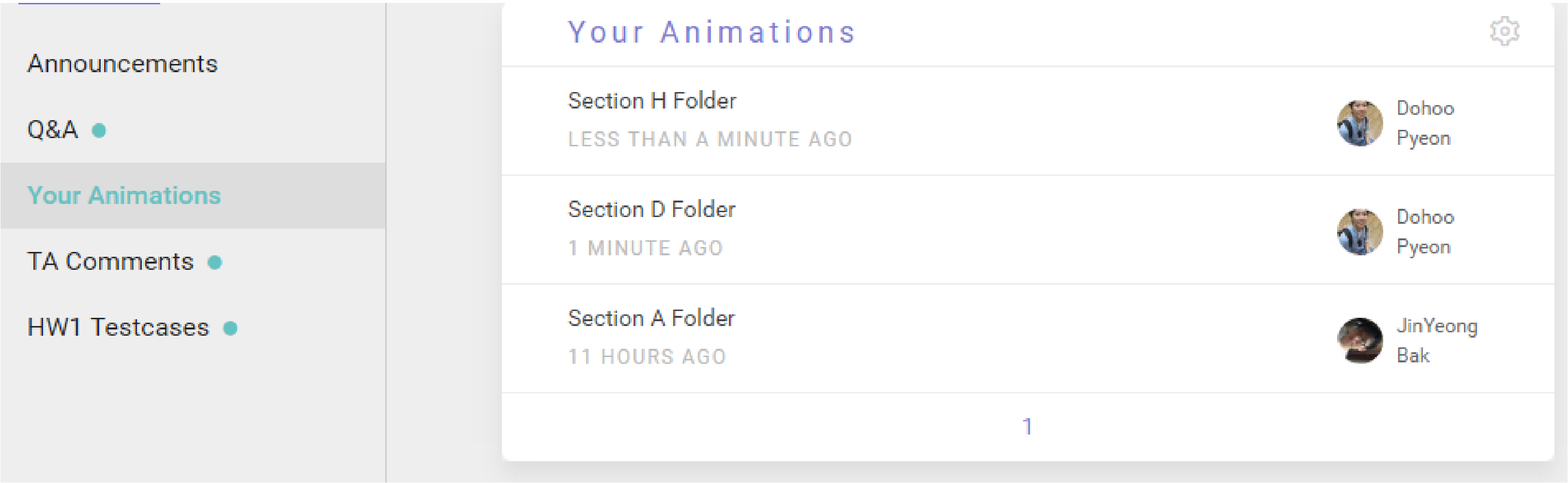
Run

```
You have no output yet.
```

Send terminal input from here.

Practices

- Bank
- Help!
- Animal Animation
  - After you finish, upload your file through the links on the "Your Animation" in *kaist.elice.io*



Announcements

Q&A ●

Your Animations

TA Comments ●

HW1 Testcases ●

Your Animations

Section H Folder
LESS THAN A MINUTE AGO
Dohoo Pyeon

Section D Folder
1 MINUTE AGO
Dohoo Pyeon

Section A Folder
11 HOURS AGO
JinYeong Bak

1

Task | Bank

- Complete ‘bank.py’

- Implement functions ‘deposit’ and ‘withdrawal’ that change the global variable ‘balance’
  - Function ‘deposit’

    balance = balance + money
  - Function ‘withdrawal’

    balance = balance – money

    If you do not have sufficient money, then print the amount of money that can withdraw

- Implement a function ‘bank’
  - It first asks

    “Deposit(d) or withdrawal(w) or balance check(c)??”
  - If user input is empty string, ‘’, then quit this function using ‘return’
  - If user input is ‘w’, then ask the amount of money to be withdrawn and withdraw it
  - If user input is ‘d’, then ask the amount of money to be deposited and deposit it
  - If user input is ‘c’, then check the current balance

Task | Bank – Example result

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Deposit(d) or withdrawal(w) or balance check(c)?? c
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How much do you want to withdraw? 9000
You've withdraw 9000 won
Deposit(d) or withdrawal(w) or balance check(c)?? w
How much do you want to withdraw? 5000
You've withdrawn 5000 won
But you only have 1000 won
Deposit(d) or withdrawal(w) or balance check(c)??
```
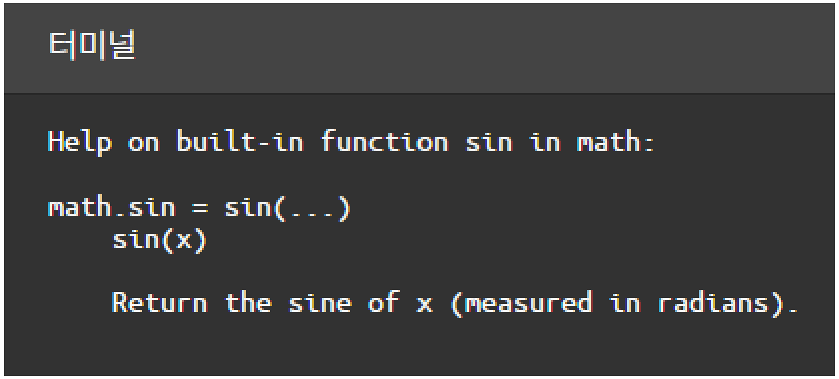

Enter

Task | Help!

- There are hundreds of pre-defined functions.

- How can programmer remember everything?
  - It’s impossible. We can ask for help!

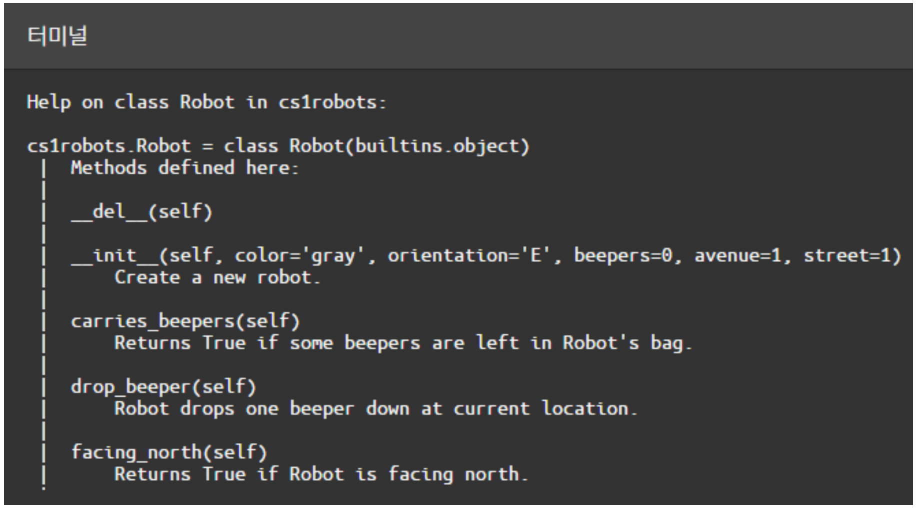
- Function help()
  - Try **help(‘print’)**
  - Try **help(‘math.sin’)**



```
Help on built-in function sin in math:

math.sin = sin(...)
    sin(x)

    Return the sine of x (measured in radians).
```

Help-system for modules

- We can also use ‘help function’ for special modules.
- Try!
  - **cs1robots**
    - help(‘cs1robots’)
    - help(‘cs1robots.Robot’)
    - help(‘cs1robots.Robot.turn_left’)
    - help(‘cs1robots.create_world’)
  - **cs1graphics**
    - help(‘cs1graphics.Ellipse’)
    - help(‘cs1graphics.Color’)
    - help(‘cs1graphics.Text’)
    - help(‘cs1graphics.Square.rotate’)



```
Help on class Robot in cs1robots:

cs1robots.Robot = class Robot(builtins.object)
 |  Methods defined here:
 |
 |  __del__(self)
 |
 |  __init__(self, color='gray', orientation='E', beepers=0, avenue=1, street=1)
 |      Create a new robot.
 |
 |  carries_beepers(self)
 |      Returns True if some beepers are left in Robot's bag.
 |
 |  drop_beeper(self)
 |      Robot drops one beeper down at current location.
 |
 |  facing_north(self)
 |      Returns True if Robot is facing north.
 |
```

Task | Animal Animation

- Implement a function ‘**draw_animal**’ that draws an animal of your choice.
  - Your animal should be drawn on a layer
  - You must be able to move the entire animal by only moving the layer.
  - The animal must also have some moving parts, such as legs, wings, or flippers.

- Write functions to change the position of these moving parts.

- Write a function ‘**show_animation**’ that shows an animation of your animal.
  - It should move around and its moving parts should be moving.

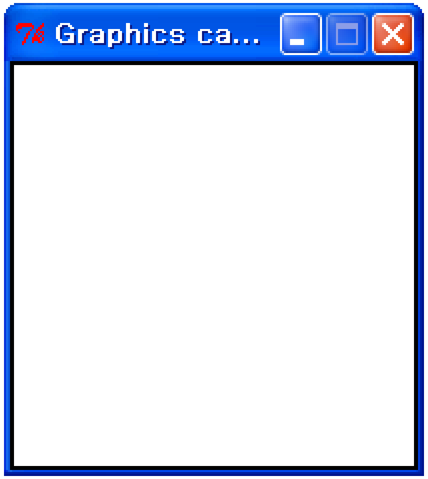
- You can choose others if it has some moving parts.
  - Ex) Cartoon character, Car, Airplane

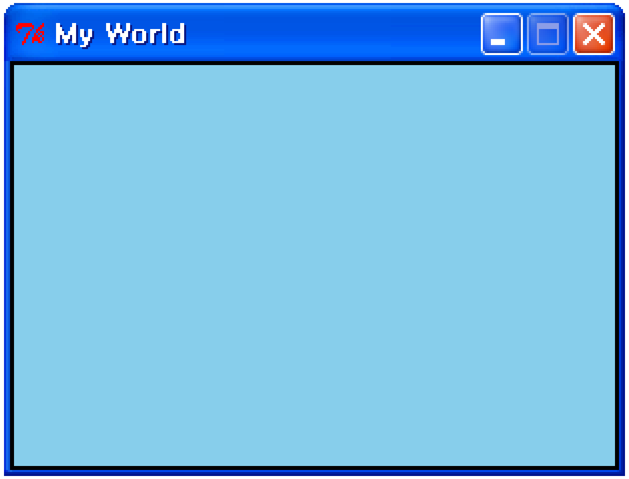
Graphical Display (1/4)

- Canvas
  - A window upon which we draw

```
from cs1graphics import*
from time import*

paper = Canvas()
```

```
paper.setBackgroundColor('skyBlue')
paper.setWidth(300)
paper.setHeight(200)
paper.setTitle('My World')
```



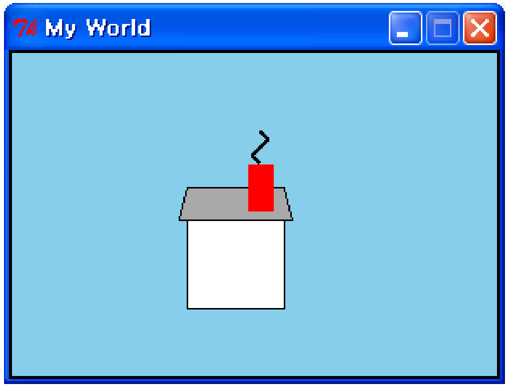


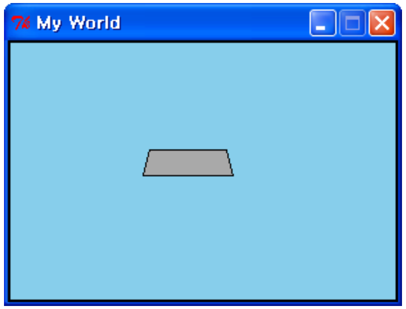
```
paper = Canvas(300, 200, 'skyBlue', 'My World')
```

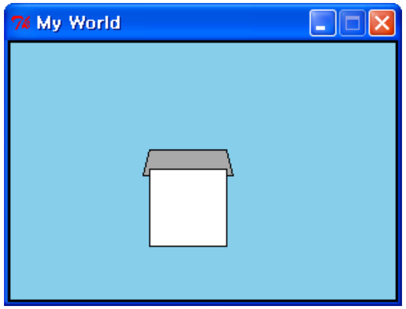
Graphical Display (2/4)

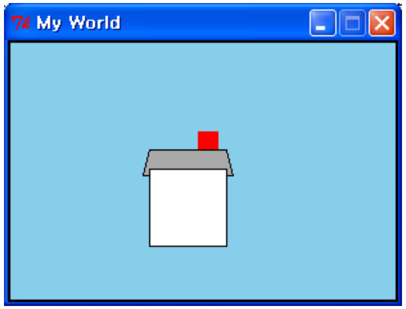
- Drawable objects
  - Polygon, Square, Rectangle, Path
  - Depth b/w drawable objects (Default. 50)

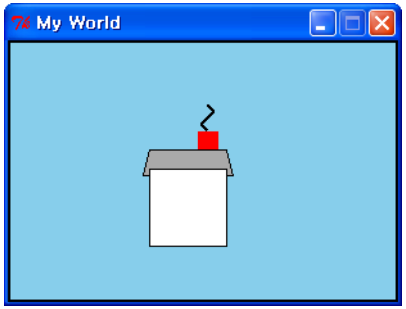
```
roof = Polygon(Point(105, 105), Point(175, 105),
Point(170, 85), Point(110, 85))
roof.setFillColor('darkgray')
roof.setDepth(30) # in front of façade
paper.add(roof)

facade = Square(60, Point(140, 130))
facade.setFillColor('white')
paper.add(façade)

chimney = Rectangle(15, 28, Point(155, 85))
chimney.setFillColor('red')
chimney.setBorderColor('red‘)
chimney.setDepth(20) # in front of roof
paper.add(chimney)

smoke = Path(Point(155, 70), Point(150, 65),
             Point(160, 55), Point(155, 50))
smoke.setBorderWidth(2)
paper.add(smoke)
```







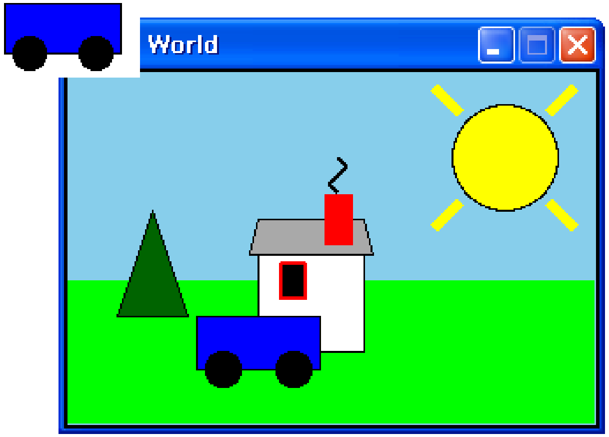




Graphical Display (3/4)

- Layer
  - Group a collection of other elements as a single composite object
  - (e.g.) A car in the world

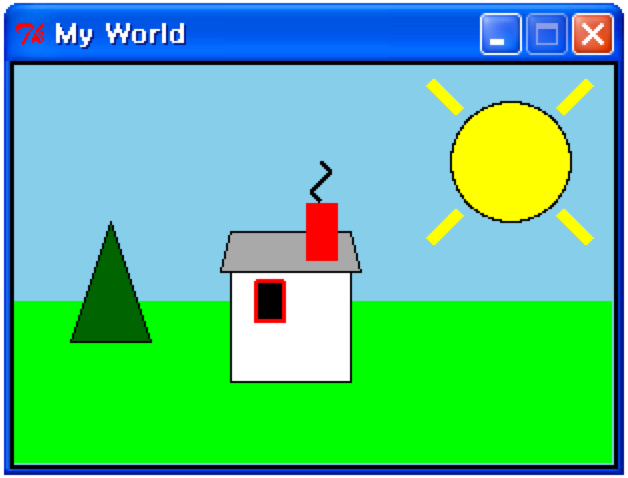
```
car = Layer()

tire1 = Circle(10, Point(-20, -10))
tire1.setFillColor('black')
car.add(tire1)

tire2 = Circle(10, Point(20, -10))
tire2.setFillColor('black')
car.add(tire2)

body = Rectangle(70, 30, Point(0, -25))
body.setFillColor('blue')
body.setDepth(60) # behind the tires
car.add(body)

car.moveTo(110, 180)
car.setDepth(20) # in front of the house
paper.add(car)
```



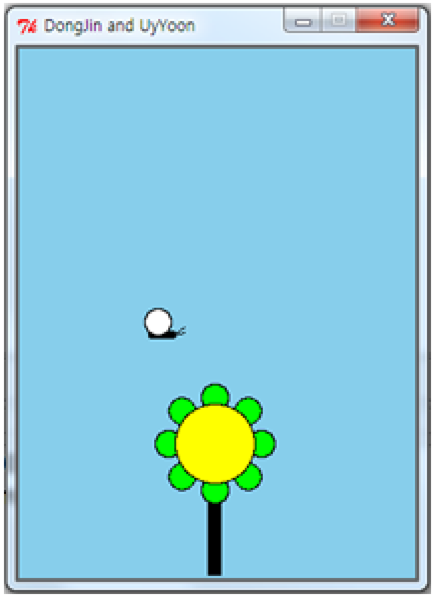
Graphical Display (4/4)

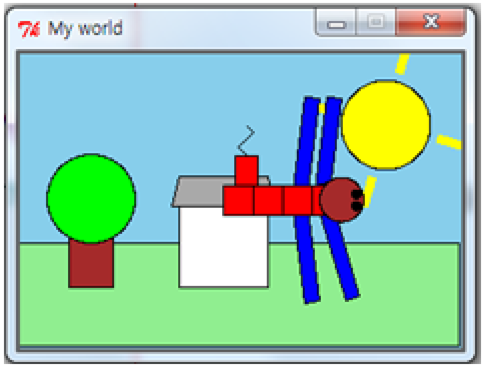
- Animation
  - Give some moves to objects
  - (e.g.) Running car in the world

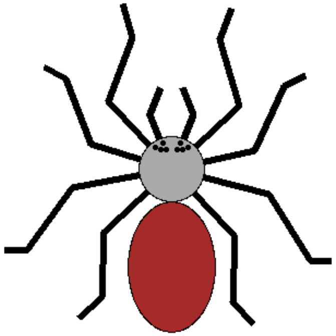
```
paper.add(car)

timeDelay = 5
sleep(timeDelay)

car.move(-10, 0)
sleep(timeDelay)

car.move(-30, 0)
sleep(timeDelay)

car.move(-60, 0)
sleep(timeDelay)

car.move(-100, 0)
sleep(timeDelay)
```

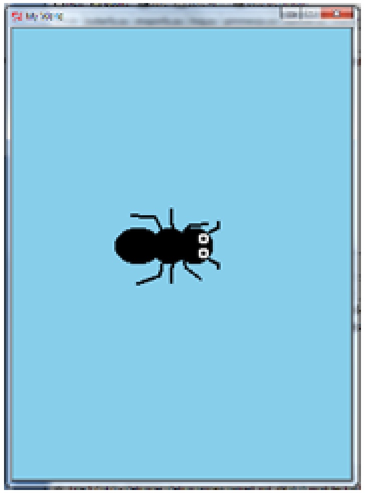


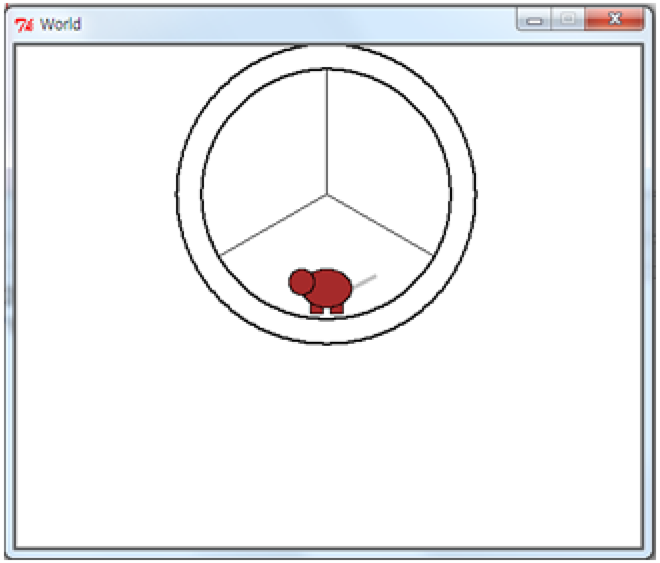
Examples

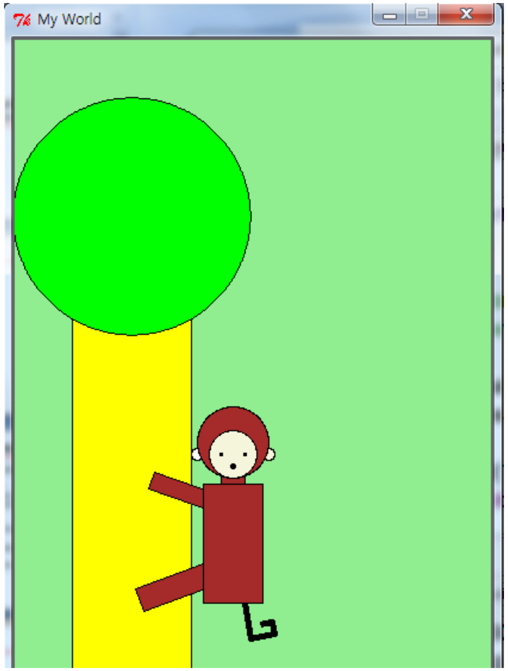






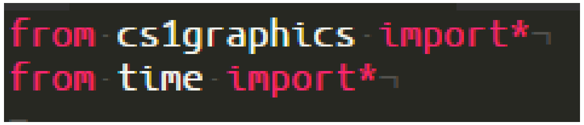






Tips

- Use ‘cs1graphics’ module and ‘time’ module.



```
from cs1graphics import*
from time import*
```

- After you choose an animal, simplify it and decide moving parts.
- When you decide moving parts, think about the functions you can use.

- Be Creative!

- Not Recommended:
  - Make more than 2 animals (If you have a lot of time, it will be okay.)
  - Choose an animal which it is hard to simplify
    - Ex) Hedgehog (고슴도치), Specific person or job (a figure skater)
  - Implement too simple thing.

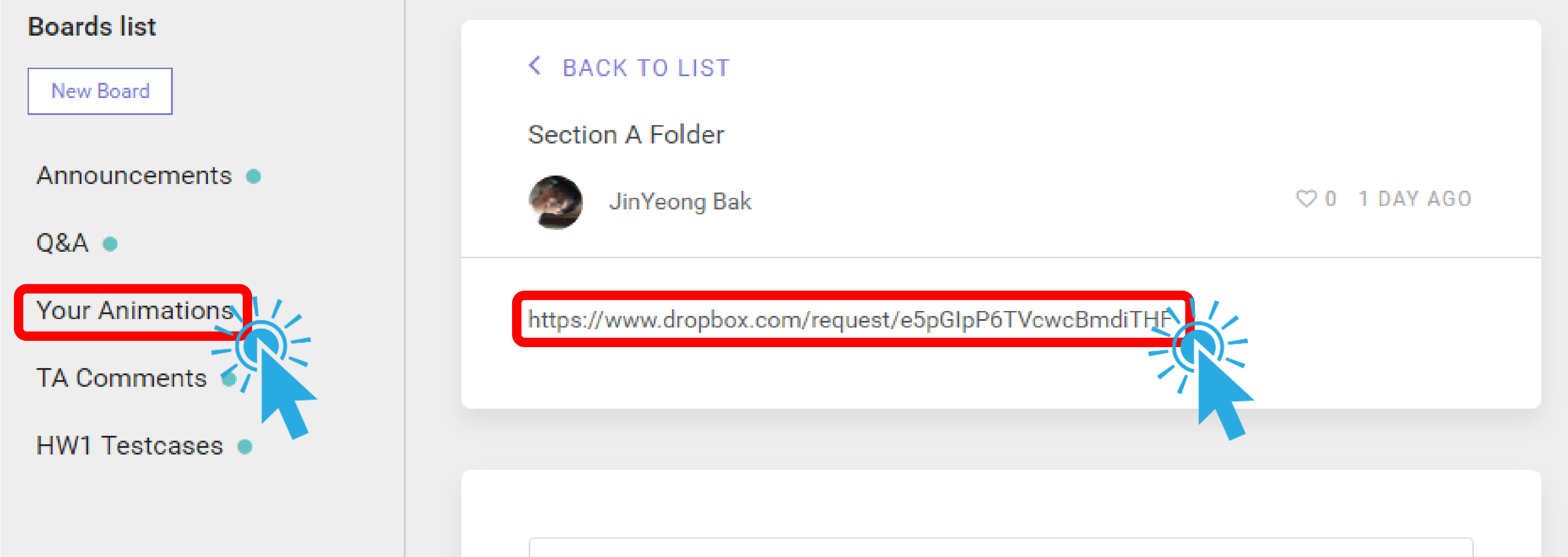
Useful cs1graphics Functions

- **Objects**
  - Canvas, Layer
  - Circle, Ellipse, Square, Rectangle, Polygon, Path, Text, …
- **Object methods**
  - Color
    - setBorderColor, setFillColor
  - Move
    - move, moveTo
  - Depth
    - setDepth
  - Others
    - rotate, scale, flip
  - Reference Point
    - getReferencePoint, adjustReference

Task | Animal Animation

- After you finish, upload your animation
- Save your animation to text file (*.txt)
  - Change the file name as

    StudentID1_StudentName1, StudentID2_Studentname2.txt
- Follow the upload link on the "Your Animations" board



Section A Folder

JinYeong Bak

https://www.dropbox.com/request/e5pGIpP6TVcwcBmdiTHF

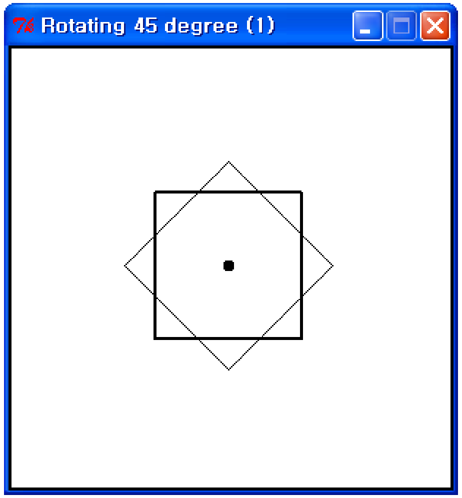
Be Creative!

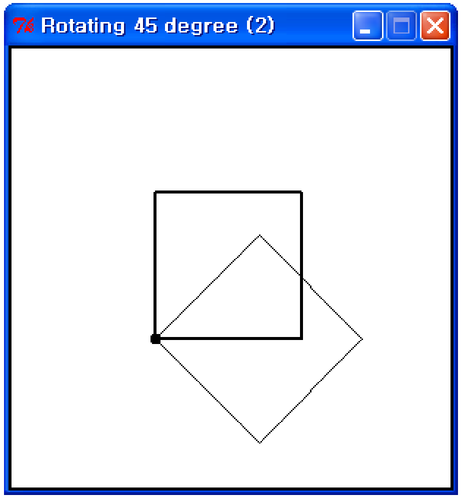
Additional Graphical Display (1/5)

- Operations on drawable objects (1)
  - Rotating

```
from cs1graphics import *

width = 300
height = 300

paper = Canvas(width, height, 'white', 'Rotating’)

square1 = Square(100, Point(width/2, height/2))
square1.setFillColor('transparent')
square1.setBorderWidth(2)
paper.add(square1)

square2 = square1.clone()
square2.rotate(45)
square2.setDepth(40)
square2.setBorderWidth(1)
paper.add(square2)
```

```
square1.adjustReference(-50, 50)
square2 = square1.clone()
square2.rotate(45)
```



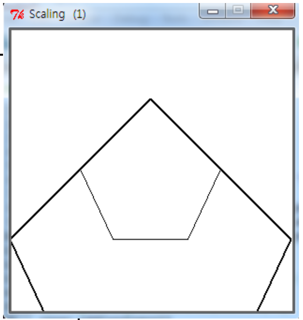


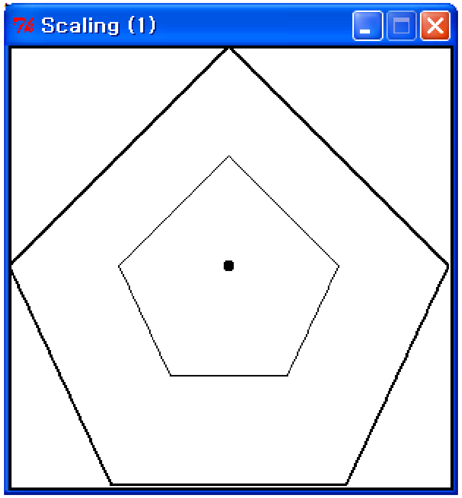
The default reference point for a square(rectangle, circle) is its center.

Additional Graphical Display (2/5)

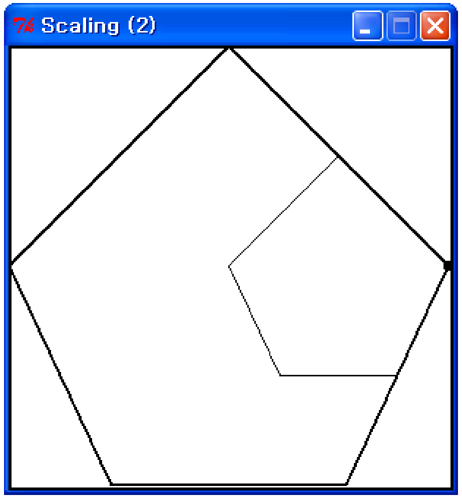
- Operations on drawable objects (2)
  - Scaling

```
from cs1graphics import *

width = 300
height = 300

paper = Canvas(width, height, 'white', 'Scaling  (1)')

pentagon1 = Polygon(Point(width/2, height/4),
   Point(width/4, height/2),  Point(width/2-40,
   height*3/4), Point(width/2+40, height*3/4),
   Point(width*3/4, height/2))

pentagon1.adjustReference(0, height/4)
paper.add(pentagon1)

pentagon2 = pentagon1.clone()
pentagon2.scale(2)
paper.add(pentagon2)
```





```
pentagon1.adjustReference(width/4, 0)

pentagon2 =  pentagon1.clone()
pentagon2.scale(2)
pentagon1.move(width/4, 0)
pentagon2.move(width/4, 0)
```



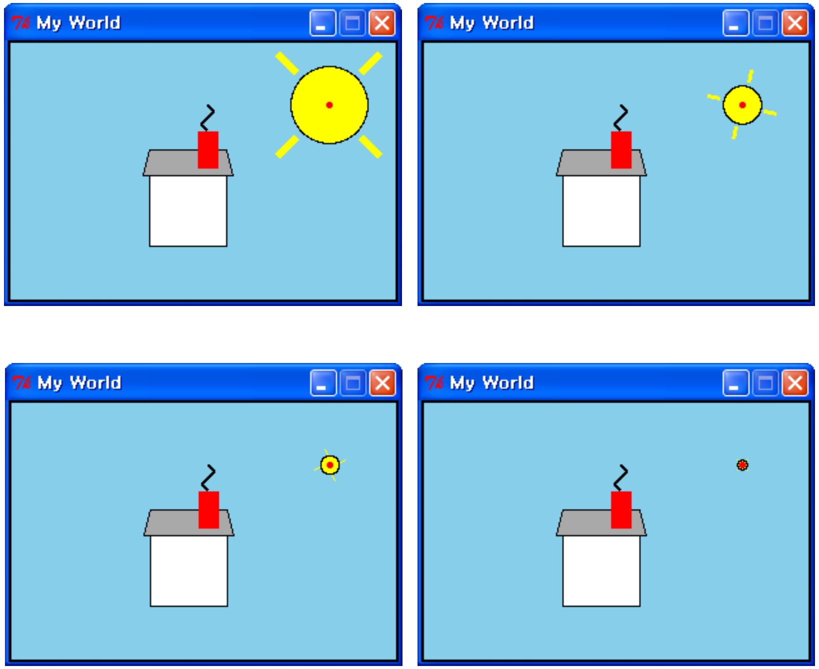
The default reference point for a polygon is initially aligned with the first point of the polygon.

Additional Graphical Display (3/5)

- How to make rotating and shrinking sun?
  - Rotating and Scaling

```
i = 0
while 0 < sun.getRadius():
    if (i % 2) == 0 :
        sunraySW.scale(1.1)
        sunraySE.scale(1.1)
        sunrayNE.scale(1.1)
        sunrayNW.scale(1.1)
        sun.scale(1.1)
    else :
        sunraySW.scale(0.9)
        sunraySE.scale(0.9)
        sunrayNE.scale(0.9)
        sunrayNW.scale(0.9)
        sun.scale(0.9)

    sunraySW.rotate(30)
    sunraySE.rotate(30)
    sunrayNE.rotate(30)
    sunrayNW.rotate(30)

    i += 1
    sleep(.05)
```

→ **from time import sleep**

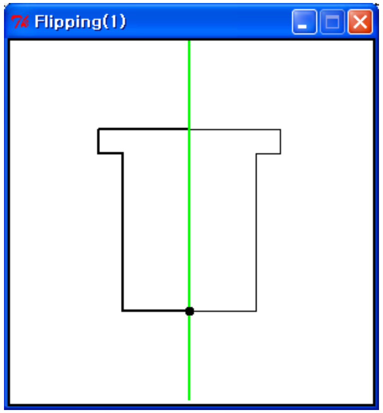


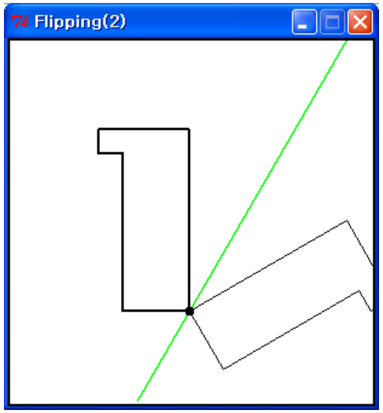
Additional Graphical Display (4/5)

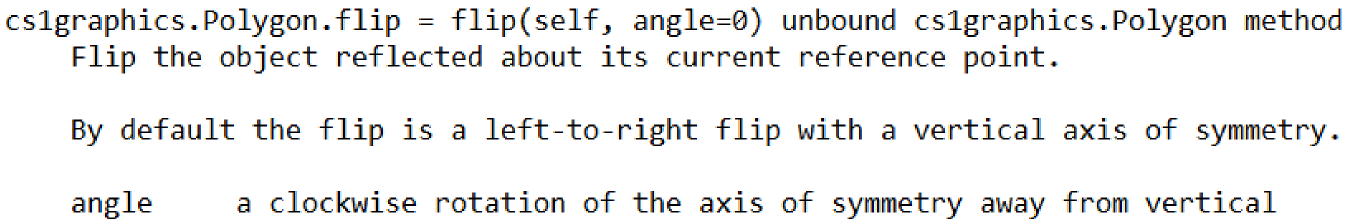
- Operations on drawable objects (3)
  - Flipping

```
width = 300
height = 300

paper = Canvas(width, height, 'white', 'Flipping(1)')

flag1 = Polygon(Point(width/2, height*3/4),
   Point(width/2, height/4), Point(width/4, height/4),
   Point(width/4, height/4+20), Point(width/4+20,
   height/4+20), Point(width/4+20, height*3/4))

paper.add(flag1)

flag2 = flag1.clone()
flag2.flip()

paper.add(flag2)
```

```
flag2.flip(30)
```





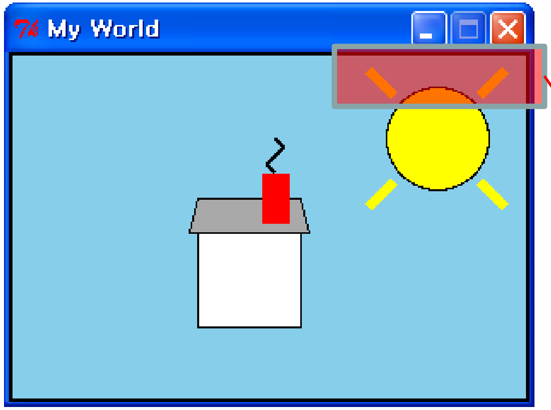


```
cs1graphics.Polygon.flip = flip(self, angle=0) unbound cs1graphics.Polygon method
    Flip the object reflected about its current reference point.

    By default the flip is a left-to-right flip with a vertical axis of symmetry.

    angle     a clockwise rotation of the axis of symmetry away from vertical
```

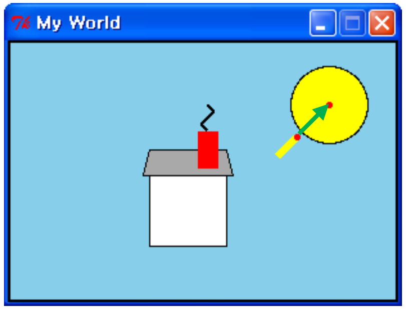
Additional Graphical Display (5/5)

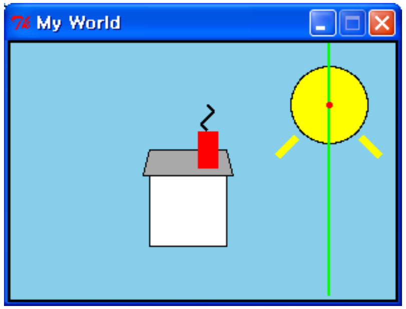
- How to avoid finding the exact geometry of each ray?
  - Cloning and Flipping

```
sunraySW = Path(Point(225, 75), Point(210, 90))
sunraySW.setBorderColor('yellow')
sunraySW.setBorderWidth(6)
paper.add(sunraySW)

# Add the sunraySE by using Cloning and Flipping
sunRefPt = sun.getReferencePoint()
sunraySWRefPt = sunraySW.getReferencePoint()

diffX = sunRefPt.getX() - sunraySWRefPt.getX()
diffY = sunRefPt.getY() - sunraySWRefPt.getY()

sunraySW.adjustReference(diffX, diffY)

sunraySE = sunraySW.clone()
sunraySE.flip()
paper.add(sunraySE)
```



These two





Let's finish the rest of two !!!
(sunrayNE and sunrayNW)

(Hint1) Clone the sunraySE rather than sunraySW
(Hint2) Use flip function with degree
(e.g.) flip(90)