

9. Display the world's borders

Modify the **SnakeWorld** constructor:

```
public SnakeWorld()
{
    super(25, 20, 32);
    addObject(new Border(), 0, 0);
}
```

Second version of the **SnakeWorld** constructor:

```
public SnakeWorld()
{
    super(25, 20, 32);

    for (int x = 0; x < getWidth(); x ++ ) {
        addObject(new Border(), x, 0);
        addObject(new Border(), x, getHeight()-1);
    }

    for (int y = 1; y < getHeight()-1; y ++ ) {
        addObject(new Border(), 0, y);
        addObject(new Border(), getWidth()-1, y);
    }
}
```

10. Display Bobby's head

Add the following **property** in the class **SnakeWorld** :

```
private LinkedList<SnakeBody> snake = new LinkedList<SnakeBody>();
```

Add the following at the beginning of the class **SnakeWorld** :

```
import java.util.*;
```

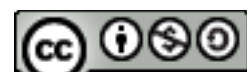
Add the following lines in the **SnakeWorld** constructor:

```
SnakeBody body = new SnakeBody();
snake.add(body);
addObject(body, 2, 2);
```

11. Bobby's Movement

Add the following lines in the **SnakeWorld** class **properties**:

```
private int dx = 1;
private int dy = 0;
```



Add this method in the **SnakeWorld** class:

```
public void act()
{
    //on remplace l'image de la tête
    SnakeBody head = snake.getLast();
    head.setImage("tail.png");

    //crée une nouvelle tête
    SnakeBody newHead = new SnakeBody();
    int newHeadX = head.getX()+dx;
    int newHeadY = head.getY()+dy;

    //ajoute la nouvelle tête à la liste et au world
    addObject(newHead, newHeadX, newHeadY);
    snake.add(newHead);
}
```

12. Limit the snake tail size

Add the following property in the **SnakeWorld** class:

```
private int tailCounter = 5;
```

Add the following lines in the **act()** method of the **SnakeWorld** class:

```
if (tailCounter == 0) {
    SnakeBody tail = snake.removeFirst();
    removeObject(tail);
} else {
    tailCounter--;
}
```

13. Change of direction

Add this method to the **SnakeWorld** class:

```
private void changeDirection() {
    if (Greenfoot.isKeyDown("left") && dx == 0 ) {
        dx = -1;
        dy = 0;
    } else if (Greenfoot.isKeyDown("right") && dx == 0 ) {
        dx = 1;
        dy = 0;
    } else if (Greenfoot.isKeyDown("down") && dy == 0 ) {
        dx = 0;
        dy = 1;
    } else if (Greenfoot.isKeyDown("up") && dy == 0 ) {
        dx = 0;
        dy = -1;
    }
}
```

Add the following line in the **act()** method of the **SnakeWorld** class (at the beginning of the method):

```
changeDirection();
```

14. Manage collisions

Add this property to the **SnakeWorld** class:

```
private boolean dead = false;
```

Add the following lines in the **act()** method of the **SnakeWorld** class:

```
if (dead) {  
    return;  
}
```

Add this method to the **SnakeWorld** class:

```
public void dead() {  
    dead = true;  
}
```

Add the following lines to the **act()** method of the **SnakeWorld** class (make sure to copy this code at the right place) :

```
List<Block> blocks = getObjectsAt(newHeadX, newHeadY, Block.class);  
for(Block block : blocks) {  
    block.collision(this);  
}
```

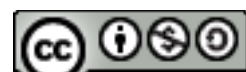
Add this method to the **Block** class:

```
public void collision(SnakeWorld world) {  
    world.dead();  
}
```

15. Add an apple

Add the following lines in the **SnakeWorld** constructor:

```
Apple apple = new Apple();  
addObject(apple,  
    Greenfoot.getRandomNumber(getWidth()-2)+1,  
    Greenfoot.getRandomNumber(getHeight()-2)+1);
```



16. Collision with an apple

Add this method to the **Apple** class:

```
public void collision(SnakeWorld world) {  
    world.grow(2);  
    setLocation(  
        Greenfoot.getRandomNumber(getWorld().getWidth()-2)+1,  
        Greenfoot.getRandomNumber(getWorld().getHeight()-2)+1);  
}
```

Add this method to the **SnakeWorld** class:

```
public void grow(int i) {  
    tailCounter = tailCounter + i;  
}
```

17. Add sounds

Add the following line in the **collision** method of the **Apple** class:

```
Greenfoot.playSound("slurp.mp3");
```

Add the following line in the **collision** method of the **Block** class:

```
Greenfoot.playSound("dead.mp3");
```