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");
```