DAT159 Refactoring - Oblig 01

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Part 1 - Refactoring steps

Extracting the switch case to its own method `determineAmount()`, but before extracting the method I extracted the `each.getMovie().getPricecode()` and `each.getDaysRented()` into separate variables.

> *from*

```
switch (each.getMovie().getPriceCode()) {
   case Movie.REGULAR:
       thisAmount += 2;
       if (each.getDaysRented() > 2)
           thisAmount += (each.getDaysRented() - 2) * 1.5;
       break;
   case Movie.NEW_RELEASE:
       thisAmount += each.getDaysRented() * 3;
       break;
   case Movie.CHILDRENS:
       thisAmount += 1.5;
       if (each.getDaysRented() > 3)
           thisAmount += (each.getDaysRented() - 3) * 1.5;
       break;
}
```

> *to*

```
int priceCode = movie.getPriceCode();
int daysRented = each.getDaysRented();
double thisAmount = determineAmount(priceCode, daysRented);


private double determineAmount(int priceCode, int daysRented) {
    double thisAmount = 0;
    switch (priceCode) {
        case Movie.REGULAR:
            thisAmount += 2;
            if (daysRented > 2)
                thisAmount += (daysRented - 2) * 1.5;
            break;
        case Movie.NEW_RELEASE:
```

```
            thisAmount += daysRented * 3;
            break;
        case Movie.CHILDRENS:
            thisAmount += 1.5;
            if (daysRented > 3)
                thisAmount += (daysRented - 3) * 1.5;
            break;
    }
    return thisAmount;
}
```

Then I moved the method over to the Movie class and created three subclasses that was each case in the switchcase `Children`, `Regular` and `NewRelease`. I made the method abstract in Movie class and then override the method in childclasses. In each class I added the code corresponding to the code inside each case in the switch.

```
Movie movie = each.getMovie();
String title = movie.getTitle();
int priceCode = movie.getPriceCode();
double thisAmount = movie.determineAmount(daysRented);


public abstract class Movie {

    [...]

    abstract double determineAmount(int daysRented);

    class Children extends Movie {

        public Children(String title, int priceCode) {
            super(title, priceCode);
        }

        @Override
        double determineAmount(int daysRented) {
            double thisAmount = 1.5;
            if (daysRented > 3)
                thisAmount += (daysRented - 3) * 1.5;
            return thisAmount;
        }
    }

    class Regular extends Movie {

```

```
        public Regular(String title, int priceCode) {
            super(title, priceCode);
        }

        @Override
        double determineAmount(int daysRented) {
            double thisAmount = 2;
            if (daysRented > 2)
                thisAmount += (daysRented - 2) * 1.5;
            return thisAmount;
        }
    }

    class NewRelease extends Movie {

        public NewRelease(String title, int priceCode) {
            super(title, priceCode);
        }

        @Override
        double determineAmount(int daysRented) {
            return daysRented * 3;
        }
    }
}
```

Extracted the frequent renterpoints lines into its own method called `getFrequentRenterPoints()`.

> *from*

```
// add frequent renter points
frequentRenterPoints ++;
// add bonus for a two day new release rental
if ((priceCode == Movie.NEW_RELEASE) &&
        daysRented > 1) frequentRenterPoints ++;
```

> *to*

```
frequentRenterPoints = getFrequentRenterPoints(frequentRenterPoints, priceCode, daysRented);


private int getFrequentRenterPoints(int frequentRenterPoints, int priceCode, int daysRented) {
    // add frequent renter points
```

```
    frequentRenterPoints ++;
    // add bonus for a two day new release rental
    if ((priceCode == Movie.NEW_RELEASE) &&
            daysRented > 1) frequentRenterPoints ++;
    return frequentRenterPoints;
}
```

Extracting the movie variable `each.getMovie()`

```
Movie movie = each.getMovie();
String title = movie.getTitle();
int priceCode = movie.getPriceCode();
frequentRenterPoints += getFrequentRenterPoints(frequentRenterPoints, priceCode, daysRented);
```

Moving the getFrequentRenterPoints from Customer class to Movie. For the special case when its an Rew Release,

Im doing a override of the method and check for the two-days rented bonus.

> *Customer.class*

```
 frequentRenterPoints += movie.getFrequentRenterPoints(frequentRenterPoints, priceCode, daysRented);
```

> *Movie.class*

```
public int getFrequentRenterPoints(int frequentRenterPoints, int priceCode, int daysRented) {
    return ++frequentRenterPoints;
}
```

> *NewRelease.class*

```
@Override
public int getFrequentRenterPoints(int frequentRenterPoints, int priceCode, int daysRented) {
    // add frequent renter points
    frequentRenterPoints++;
    // add bonus for a two day new release rental
    if (daysRented > 1) frequentRenterPoints++;
    return frequentRenterPoints;
}
```

Then removing the constant in the top of the class

> *Deleting*

```
public static final int CHILDRENS = 2;
public static final int REGULAR = 0;
public static final int NEW_RELEASE = 1;
```

Extracting the footer lines to its own method.

> *from*

```
//add footer lines
result += "Amount owed is " + String.valueOf(totalAmount) + "\n";
result += "You earned " + String.valueOf(frequentRenterPoints) +
" frequent renter points";
```

> *to*

```
result += getFooterLines(totalAmount, frequentRenterPoints, result);

private String getFooterLines(double totalAmount, int frequentRenterPoints, String result) {
    //add footer lines
    result += "Amount owed is " + String.valueOf(totalAmount) + "\n";
    result += "You earned " + String.valueOf(frequentRenterPoints) +
            " frequent renter points";
    return result;
}
```

Extracting the result string to its own method, and removing String.valueOf, since its not doing any thing in this case, we can easily print out double in Java 8 without wrapping it.

> *from*

```
result += ("\t" + title + "\t" + String.valueOf(thisAmount) + "\n");
```

> *to*

```
result += printFiguresForRental(title, thisAmount);


private String printFiguresForRental(String result, String title, double thisAmount) {
    return "\t" + title + "\t" + thisAmount + "\n";
}
```

Since I was using the Extract Variable strategy it left me with some parameters that was no longer in use after I implemented polymorphism.

> *from*

```
// Customer.class
int priceCode = movie.getPriceCode();
frequentRenterPoints += movie.getFrequentRenterPoints(frequentRenterPoints, priceCode, daysRented);


// Movie.class
public int getFrequentRenterPoints(int frequentRenterPoints, int daysRented) {
    return ++frequentRenterPoints;
}

// NewRelease.class
@Override
public int getFrequentRenterPoints(int frequentRenterPoints, int priceCode, int daysRented) {
    // add frequent renter points
    frequentRenterPoints++;
    // add bonus for a two day new release rental
    if (daysRented > 1) frequentRenterPoints++;
    return frequentRenterPoints;
}
```

Final Result

> `Customer.java`

```
public class Customer {
    private String _name;
    private ArrayList<Rental> _rentals = new ArrayList<>();

    public Customer(String name) {
        _name = name;
    }

    public String statement() {
        double totalAmount = 0;
        int frequentRenterPoints = 0;
        Iterator<Rental> rentals = _rentals.iterator();
        String result = "Rental Record for " + getName() + "\n";
        while (rentals.hasNext()) {
            Rental each = rentals.next();
```

```
            int daysRented = each.getDaysRented();
            Movie movie = each.getMovie();

            frequentRenterPoints += movie.getFrequentRenterPoints(frequentRenterPoints, daysRented);

            String title = movie.getTitle();
            double thisAmount = movie.determineAmount(daysRented);
            result += printFiguresForRental(title, thisAmount);
            totalAmount += thisAmount;
        }
        result += getFooterLines(totalAmount, frequentRenterPoints, result);
        return result;
    }

    private String printFiguresForRental(String title, double thisAmount) {
        return ("\t" + title + "\t" + thisAmount + "\n");
    }

    private String getFooterLines(double totalAmount, int frequentRenterPoints, String result) {
        return result
                + "Amount owed is " + totalAmount + "\n"
                + "You earned " + frequentRenterPoints
                + " frequent renter points";
    }

    public void addRental(Rental arg) {
        _rentals.add(arg);
    }

    public String getName() {
        return _name;
    }
}
```

Movie.java

```
public abstract class Movie {

    private String _title;
    private int _priceCode;

    public Movie(String title, int priceCode) {
        _title = title;
```

```
        _priceCode = priceCode;
    }

    public int getPriceCode() {
        return _priceCode;
    }

    public void setPriceCode(int _priceCode) {
        this._priceCode = _priceCode;
    }

    public String getTitle() {
        return _title;
    }

    public abstract double determineAmount(int daysRented);

    public int getFrequentRenterPoints(int frequentRenterPoints, int daysRented) {
        return ++frequentRenterPoints;
    }


    class Children extends Movie {

        public Children(String title, int priceCode) {
            super(title, priceCode);
        }

        @Override
        public double determineAmount(int daysRented) {
            double thisAmount = 1.5;
            if (daysRented > 3)
                thisAmount += (daysRented - 3) * 1.5;
            return thisAmount;
        }
    }

    class Regular extends Movie {

        public Regular(String title, int priceCode) {
            super(title, priceCode);
        }

        @Override
        public double determineAmount(int daysRented) {
```

```
            double thisAmount = 2;
            if (daysRented > 2)
                thisAmount += (daysRented - 2) * 1.5;
            return thisAmount;
        }
    }

    class NewRelease extends Movie {

        public NewRelease(String title, int priceCode) {
            super(title, priceCode);
        }

        @Override
        public double determineAmount(int daysRented) {
            return daysRented * 3;
        }

        @Override
        public int getFrequentRenterPoints(int frequentRenterPoints, int daysRented) {
            // add frequent renter points
            frequentRenterPoints++;
            // add bonus for a two day new release rental
            if (daysRented > 1) frequentRenterPoints++;
            return frequentRenterPoints;
        }
    }
}
```

> *Rental.java*

```
public class Rental {
    private Movie _movie;
    private int _daysRented;

    public Rental(Movie movie, int daysRented) {
        _movie = movie;
        _daysRented = daysRented;
    }

    public Movie getMovie() {
        return _movie;
    }
```

```
    public int getDaysRented() {
        return _daysRented;
    }
}
```

Part 2 - Measure SLOC and McCabe's Cyclomatic Complexity on `Customer.statement()` method

The SLOC - Source lines of code before was 43 lines. After the refactoring the number of lines is now 21.

So by refactoring we reduced the lines of code with 49%.

The Cyclomatic Complexity is measured by the number of linearly independent paths through a program's source code.

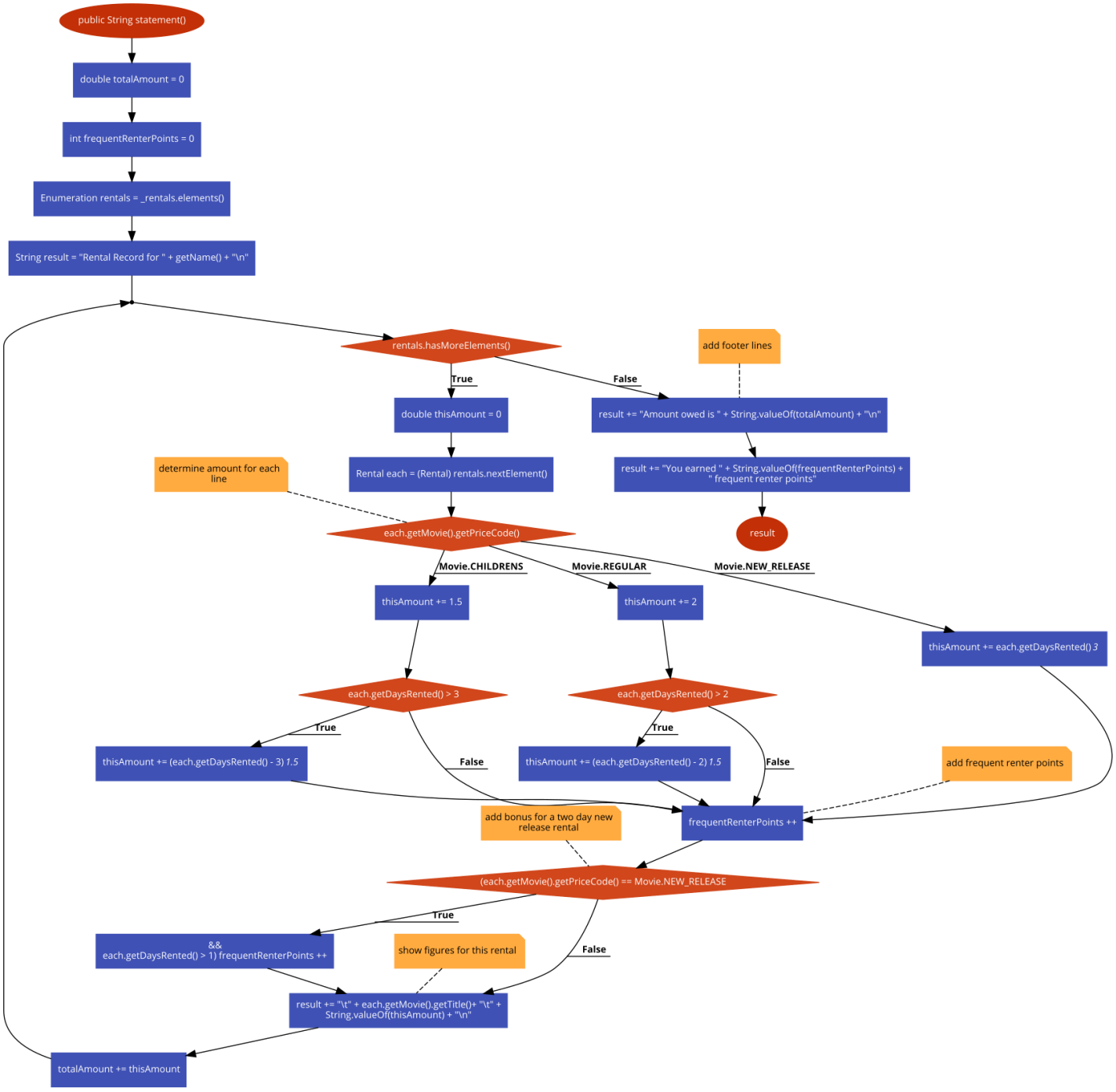
The complexity **M** is defined as `M = E − N + 2` for a single method.

Where

- E = the number of edges of the graph
- N = the number of nodes of the graph

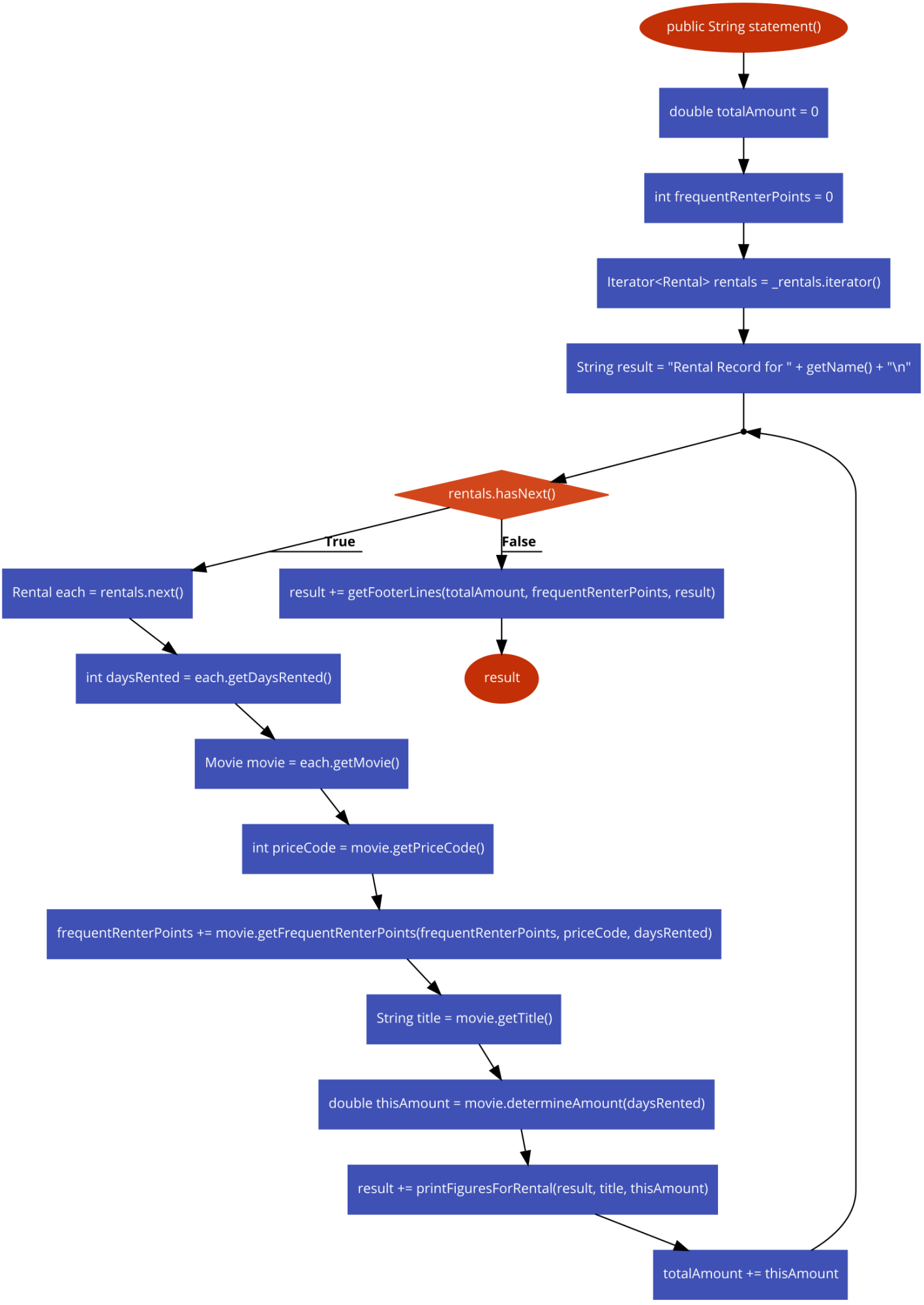
Before the refactoring the Complexity was 9.

30 number of edges - 23 number of nodes + 2 = 9



After the refactoring the complexity was 2.

17 number of edges - 17 number of nodes + 2 = 2


public String statement()
double totalAmount = 0
int frequentRenterPoints = 0
Iterator<Rental> rentals = _rentals.iterator()
String result = "Rental Record for " + getName() + "\n"
rentals.hasNext()
True
False
Rental each = rentals.next()
result += getFooterLines(totalAmount, frequentRenterPoints, result)
int daysRented = each.getDaysRented()
result
Movie movie = each.getMovie()
int priceCode = movie.getPriceCode()
frequentRenterPoints += movie.getFrequentRenterPoints(frequentRenterPoints, priceCode, daysRented)
String title = movie.getTitle()
double thisAmount = movie.determineAmount(daysRented)
result += printFiguresForRental(result, title, thisAmount)
totalAmount += thisAmount

The tools that was used was code2flow to draw the graph, and

lizard.ws to check the Cyclomatic Complexity.

Part 3 - PullUp Method going wrong

If we imagine that we have a SuperDuper class that is on top in the hierarchy, this SuperDuper class have a method `magic(int x)` who takes in an integer and does something magic. Underneath we have a Super class who inheritance from SuperDuper class. And Super class has to children Foo and Bar.

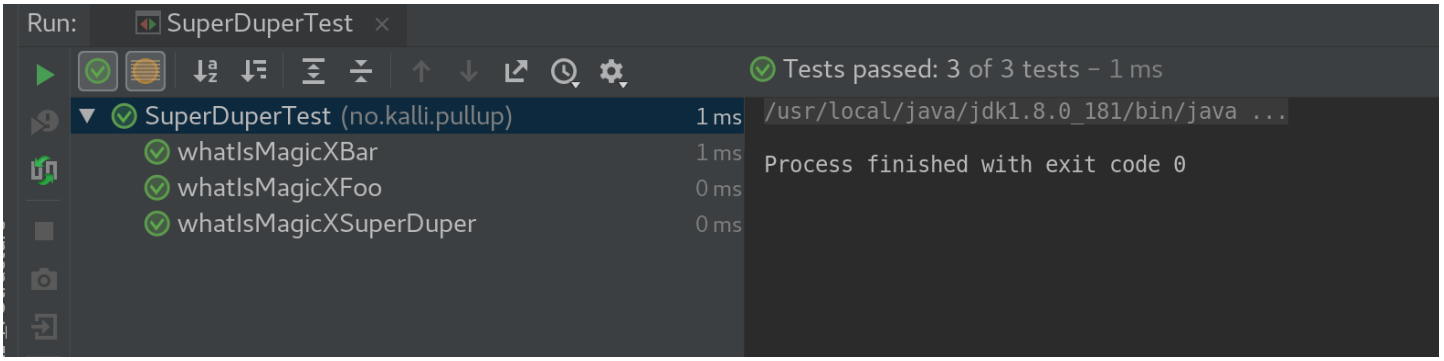
Let us imagine that `Bar.magix(int x)` is a new method in class Bar, and now we want to refactor and move it up to the Super class...

```
public class SuperDuper {
    public int magic(int x) {
        return x + 1;
    }
}

class Super extends SuperDuper {}

class Foo extends Super {
    @Override
    public int magic(int x) {
        return super.magic(x) + 1;
    }
}

class Bar extends Super {
    @Override
    public int magic(int x) {
        return super.magic(x) + 2;
    }
}
```

Before the refactoring Unit test passes.

```
public class SuperDuperTest {

    private final int X = 1;
    private SuperDuper omg;
    private Foo foo;
    private Bar bar;

    @Before
    public void setUp() throws Exception {
```

```
        omg = new SuperDuper();
        foo = new Foo();
        bar = new Bar();
    }

    @Test
    public void whatIsMagicXSuperDuper() {
        assertEquals(2, omg.magic(X));
    }

    @Test
    public void whatIsMagicXFoo() {
        assertEquals(3, foo.magic(X));
    }

    @Test
    public void whatIsMagicXBar() {
        assertEquals(4, bar.magic(X));
    }
}
```

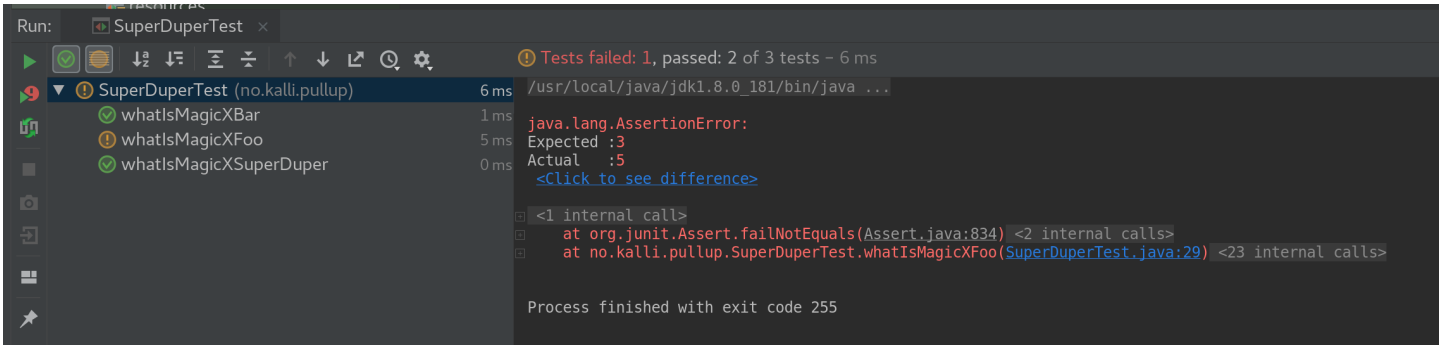


So then we do the refactoring, we move the `bar.magic(int x)` up to the Super class

```
public class SuperDuper {

    public int magic(int x) {
        return x + 1;
    }
}

class Super extends SuperDuper {
    @Override
    public int magic(int x) {
        return super.magic(x) + 2;
    }
```

```
}

class Foo extends Super {
    @Override
    public int magic(int x) {
        return super.magic(x) + 1;
    }
}

class Bar extends Super {}
```

And run the Unit test again:



Then we see that `whatIsMagicXFoo()` is returning 5 instead of 3.

But the Bar class is still working properly, so if we had forgotten to Unit test the Foo class,

we would never notice that we messed up our code by moving the `magix(int x)` method up the hierarchy