IS1S481 Coursework 1

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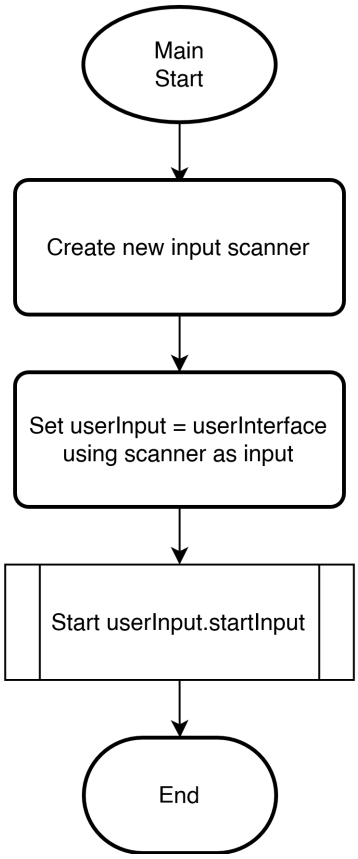


Figure 1: Flowchart of Main

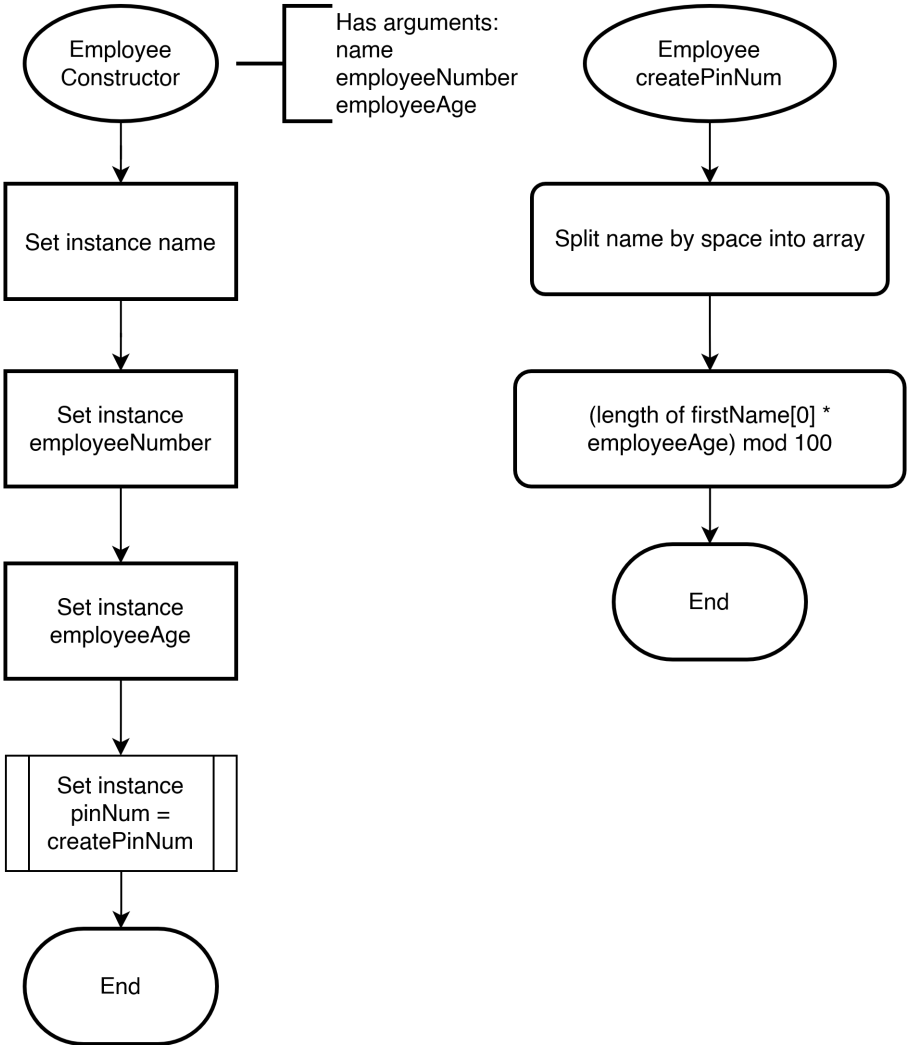


Figure 2: Flowchart of Employee

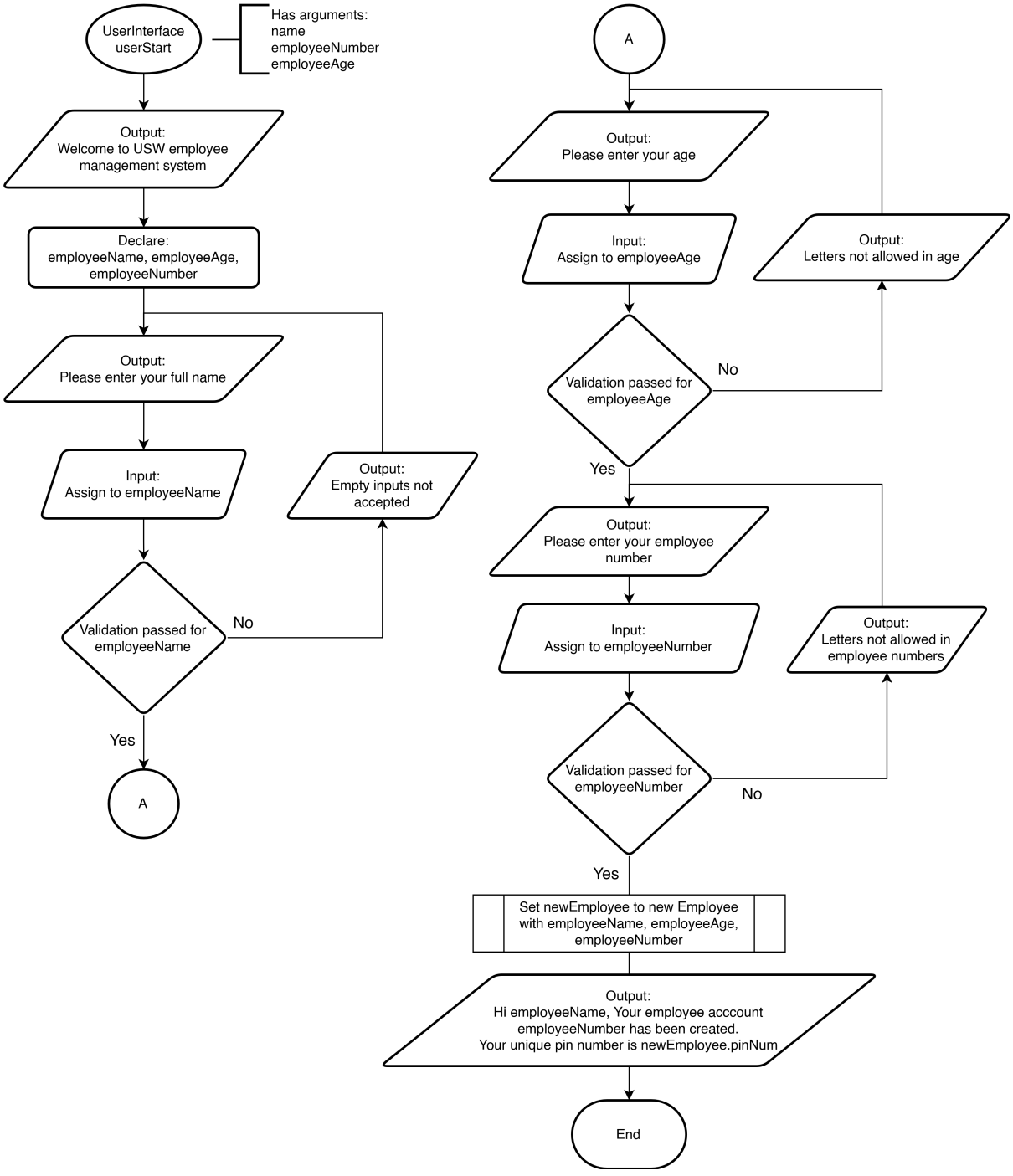


Figure 3: Flowchart of UserInterface

Part 2 - Employee Pay Calculator

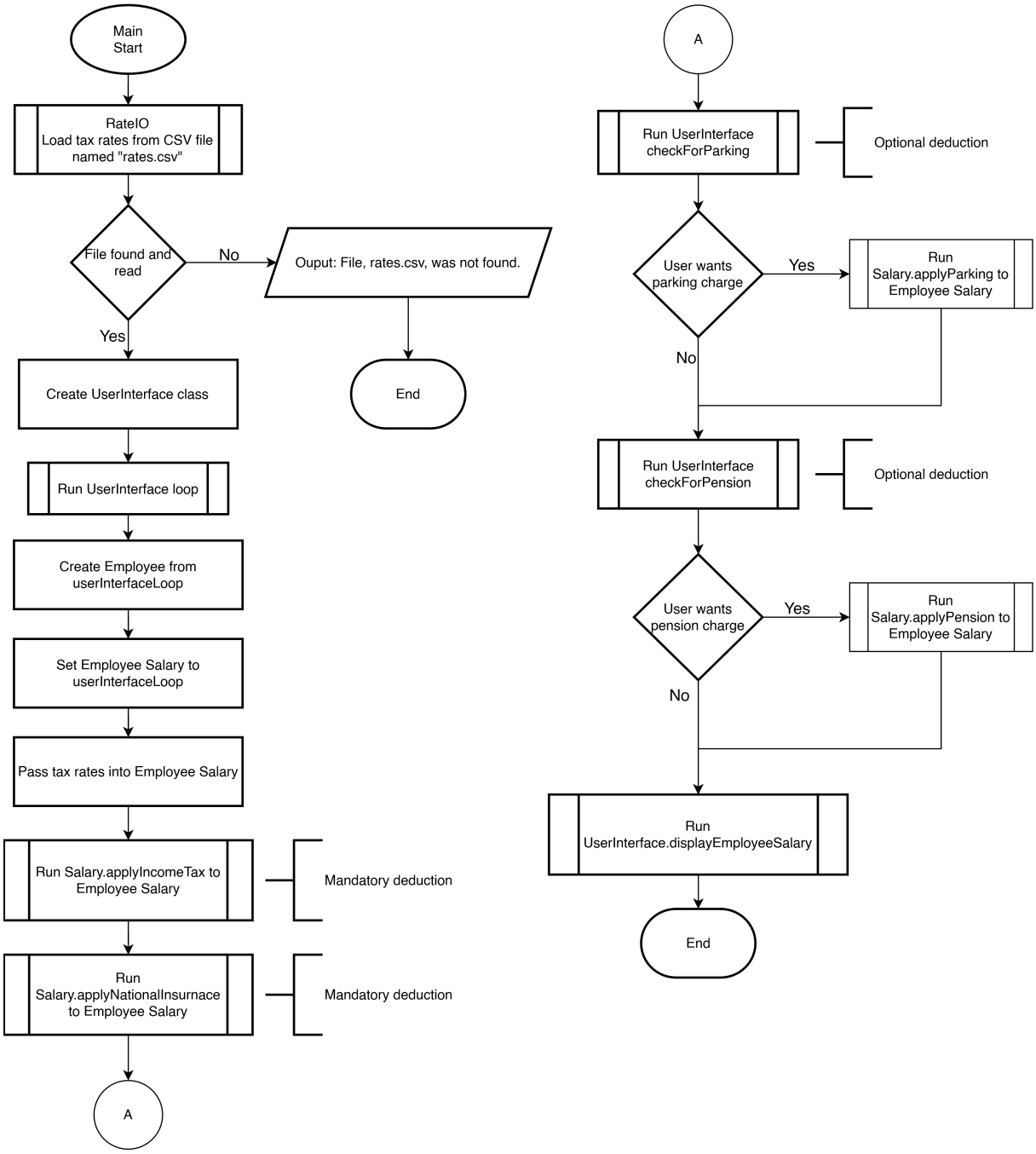


Figure 4: Flowchart of Main

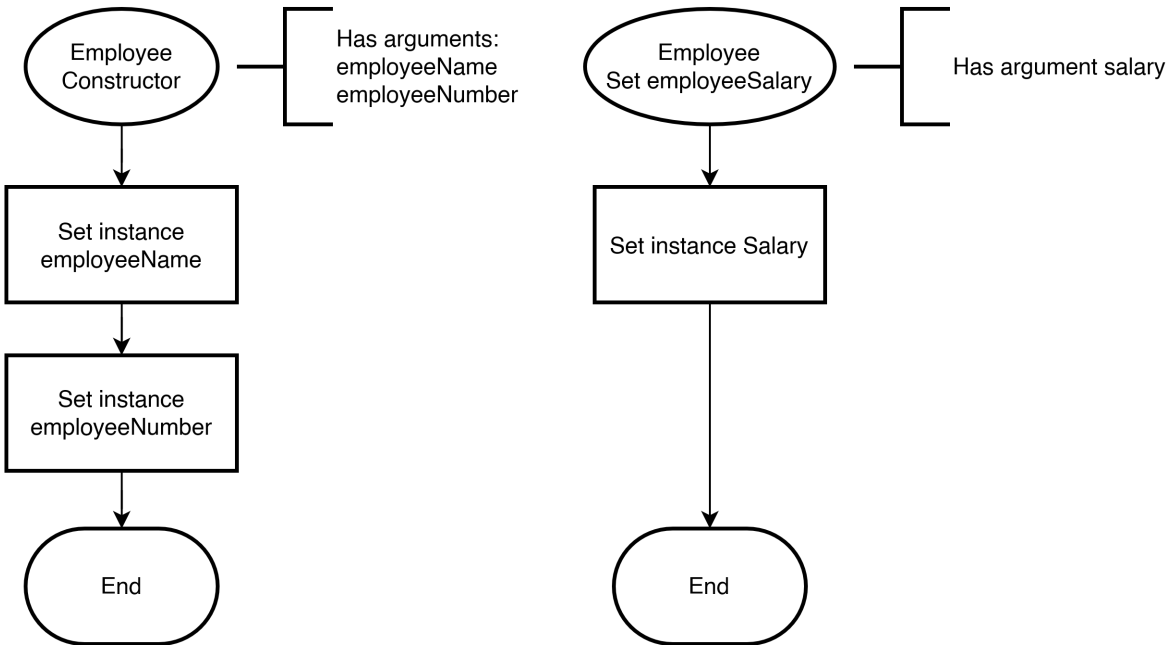


Figure 5: Flowchart of Employee

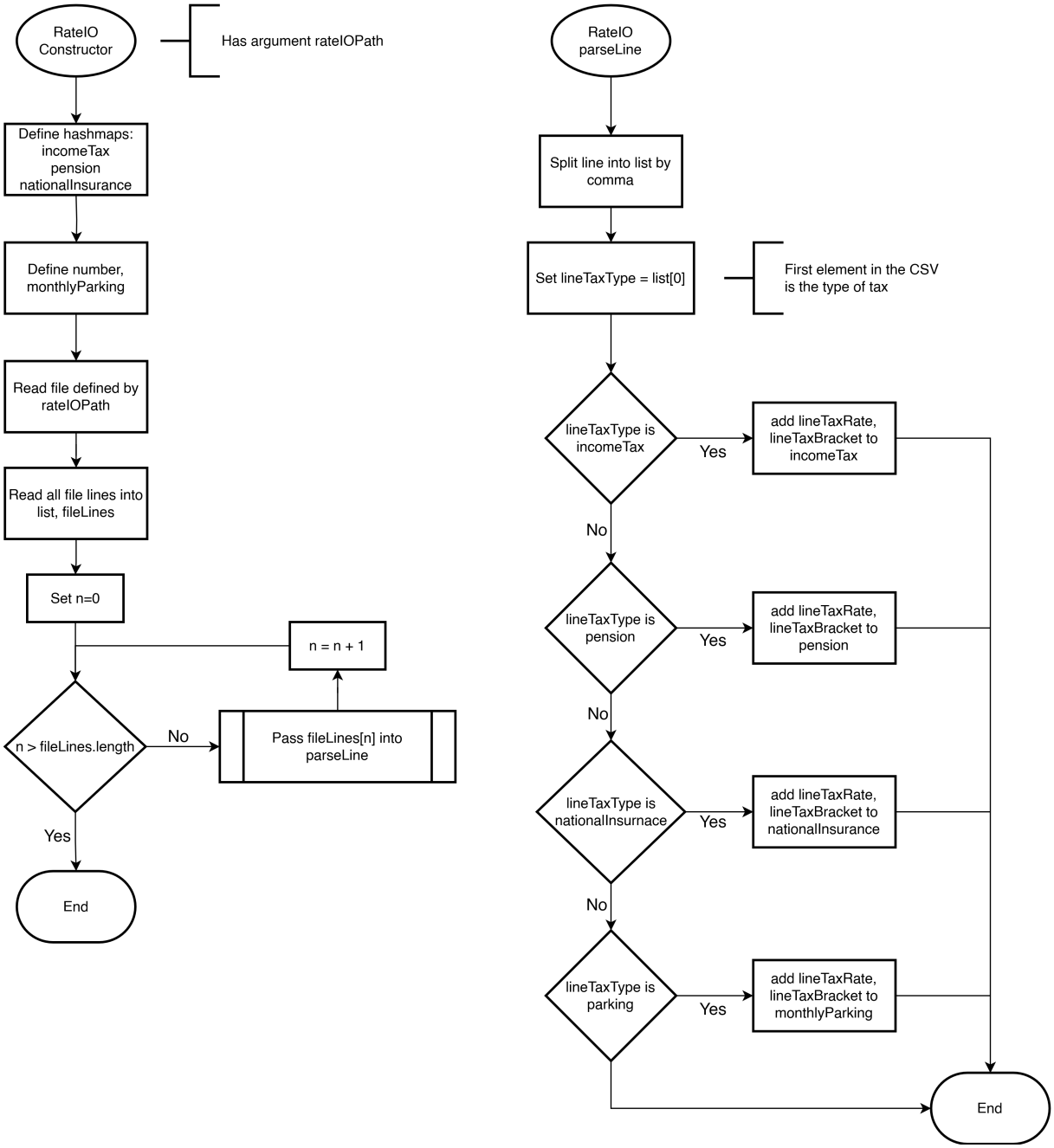
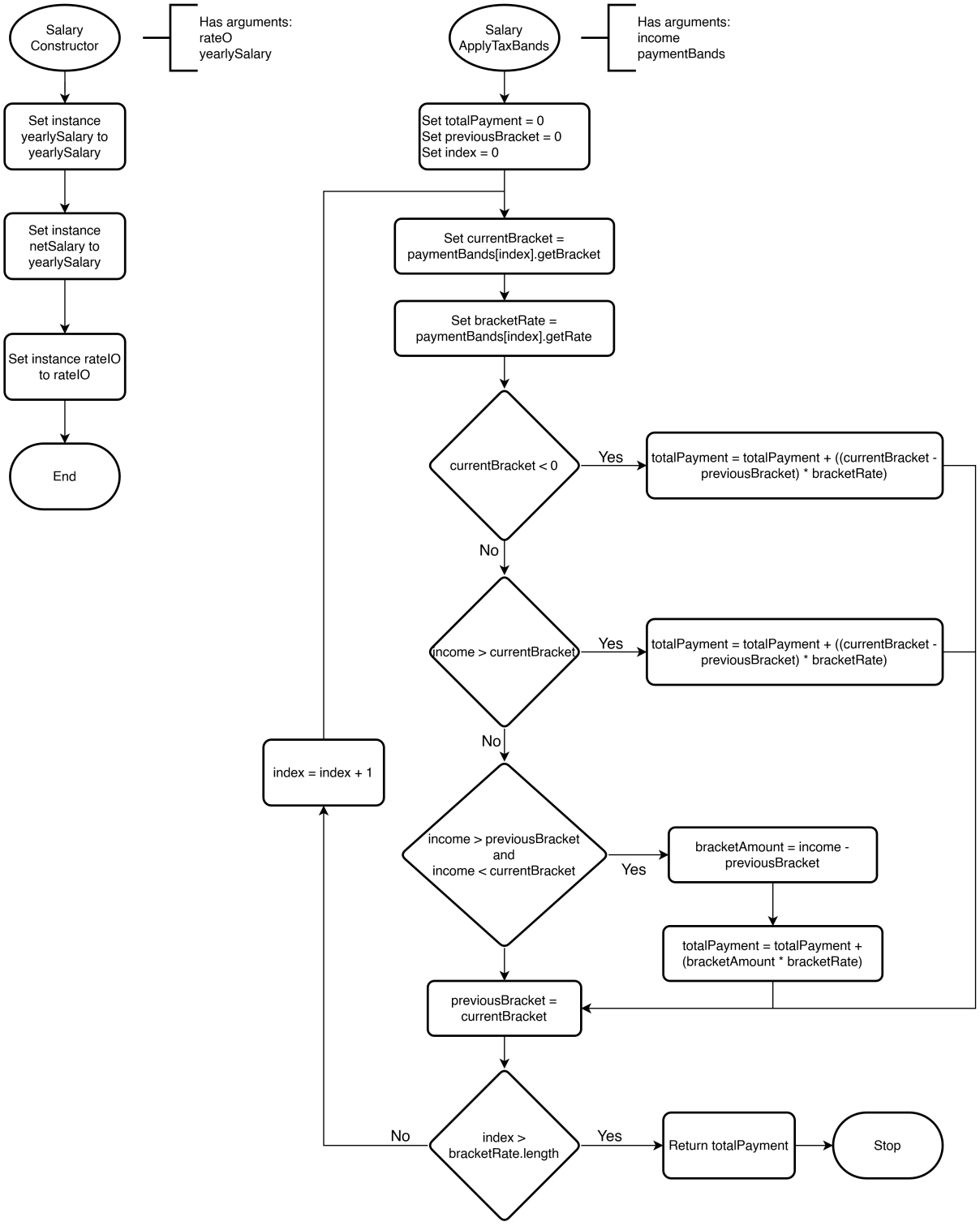


Figure 6: Flowchart of RateIO



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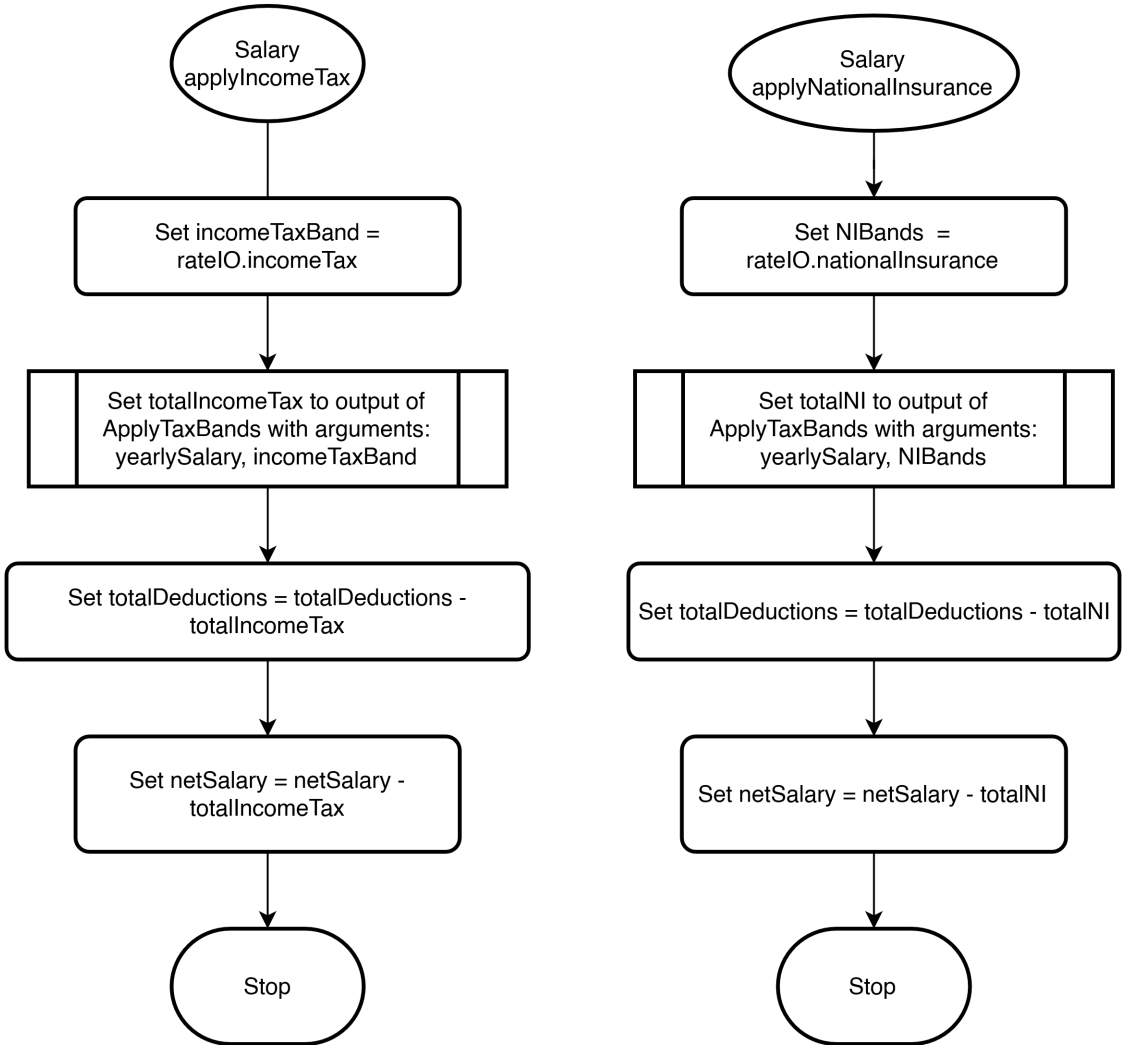

Figure 8: 2nd Flowchart of Salary

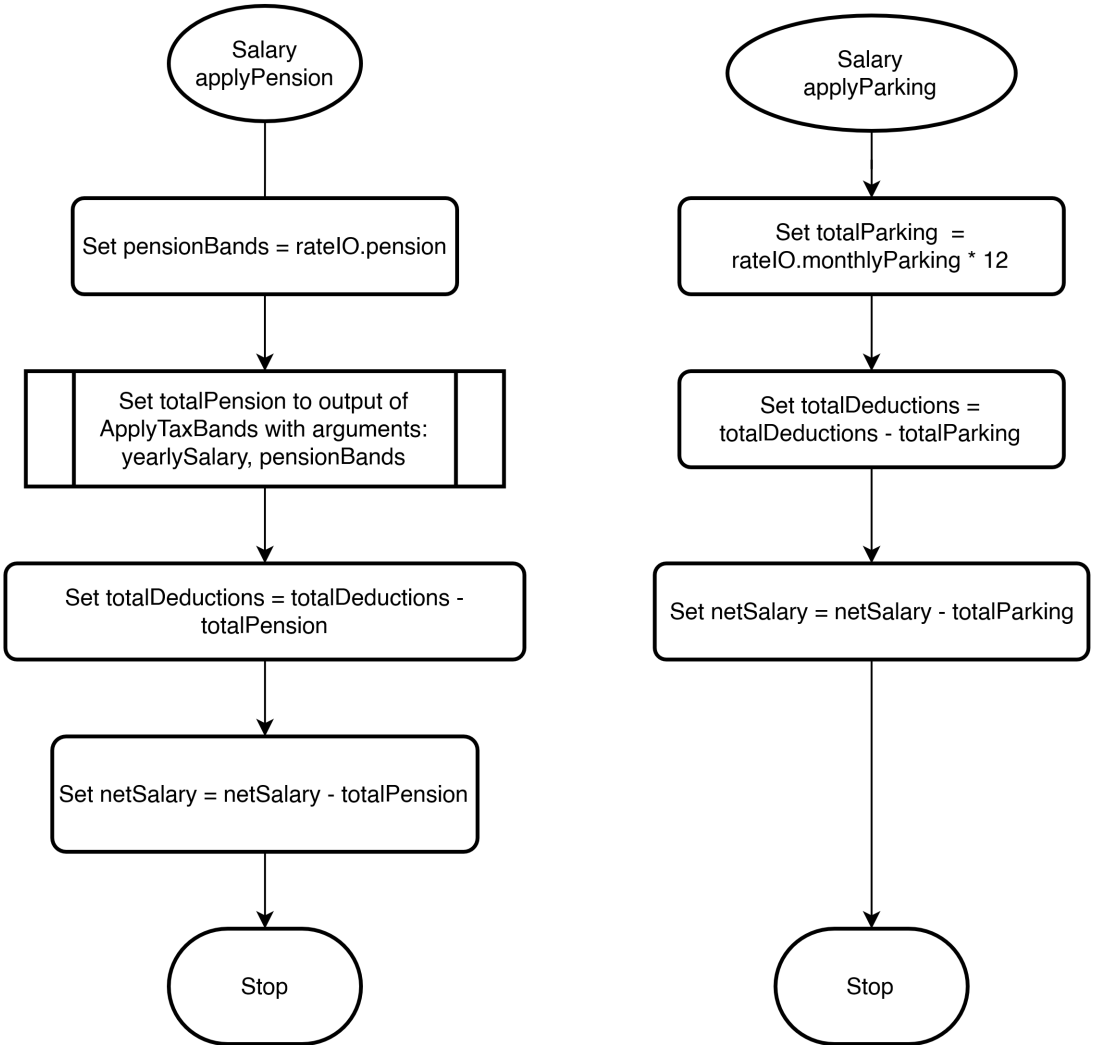

Figure 9: 3rd Flowchart of Salary

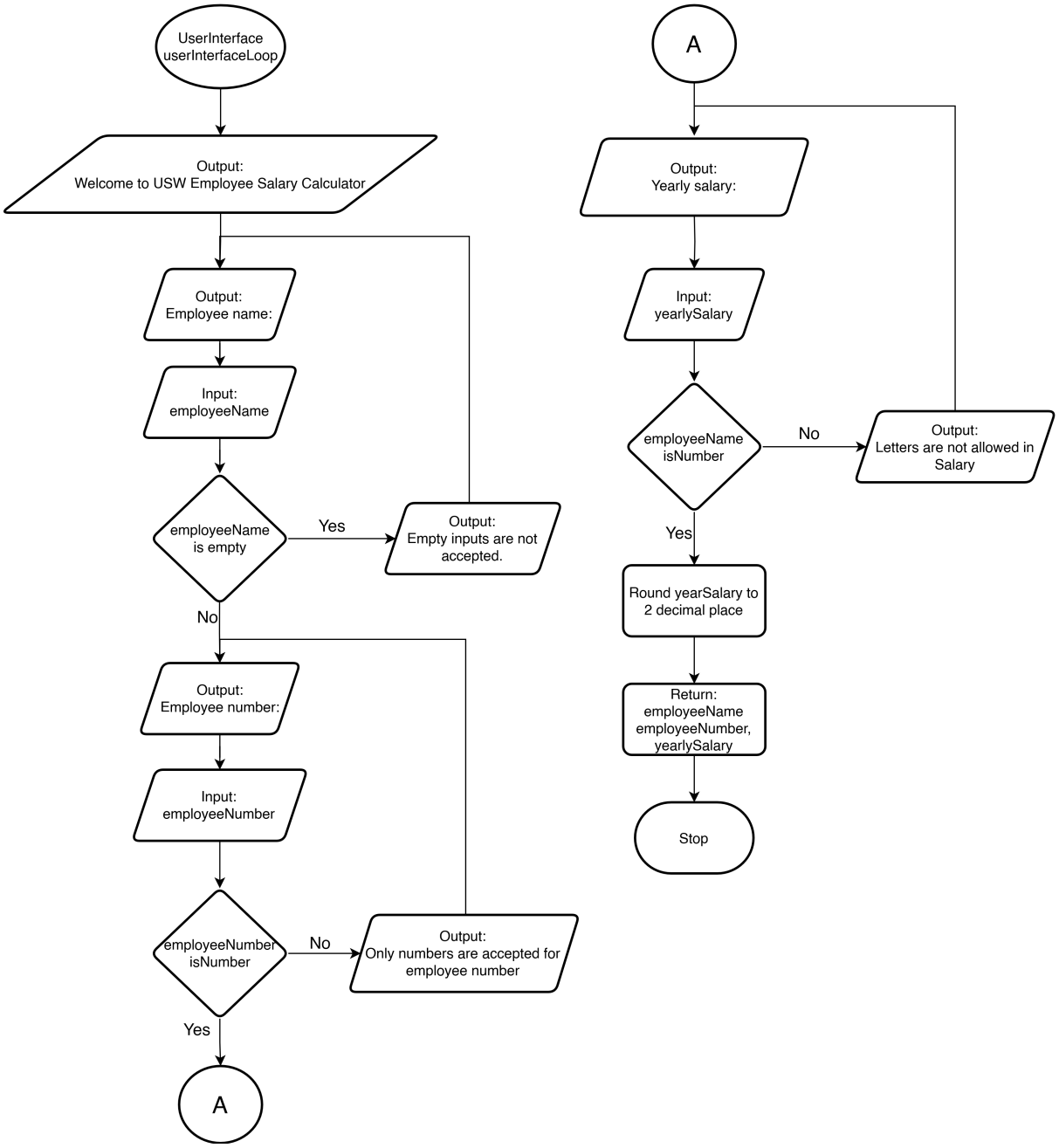

Figure 10: Flowchart of UserInterface

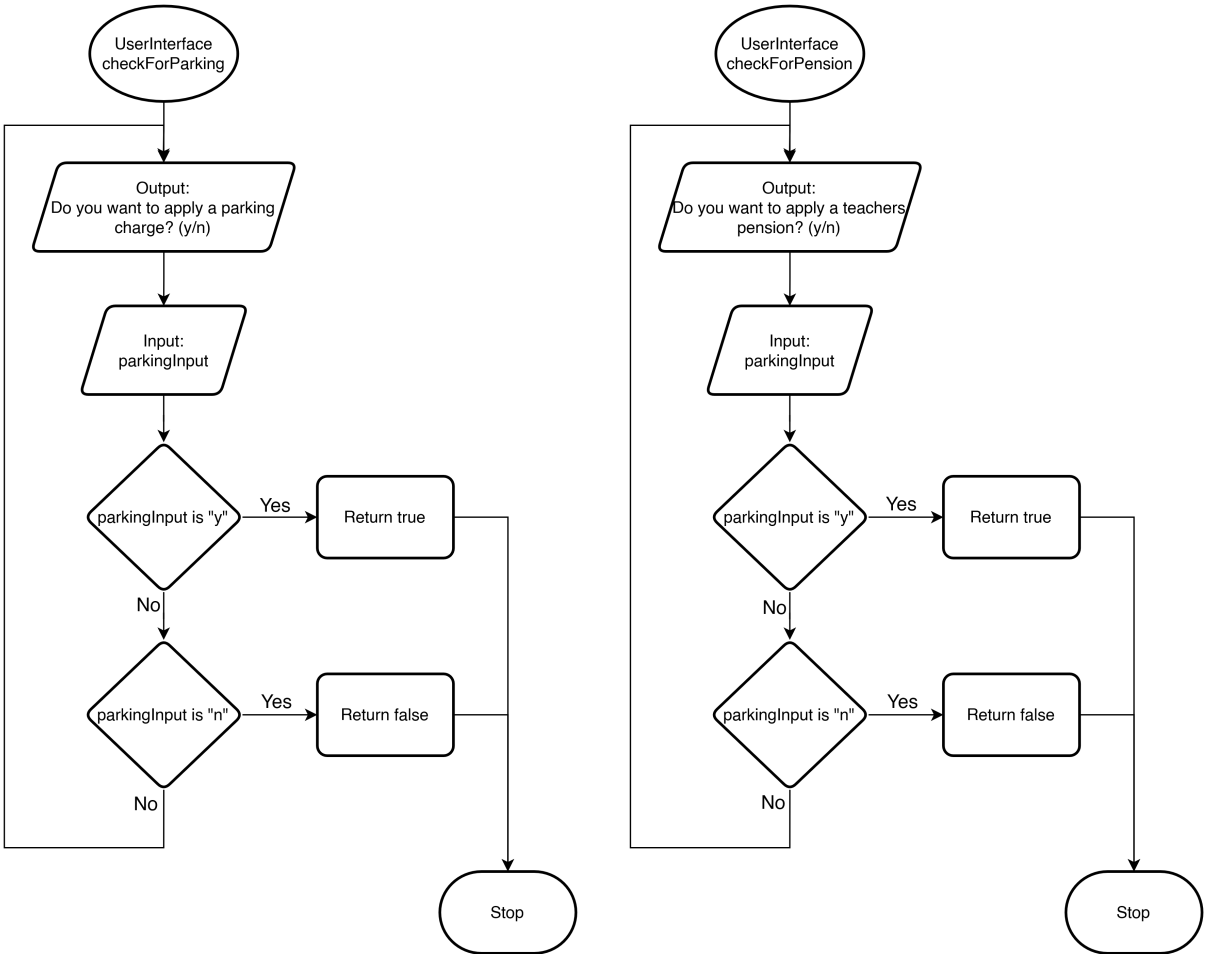

Figure 11: 2nd Flowchart of UserInterface

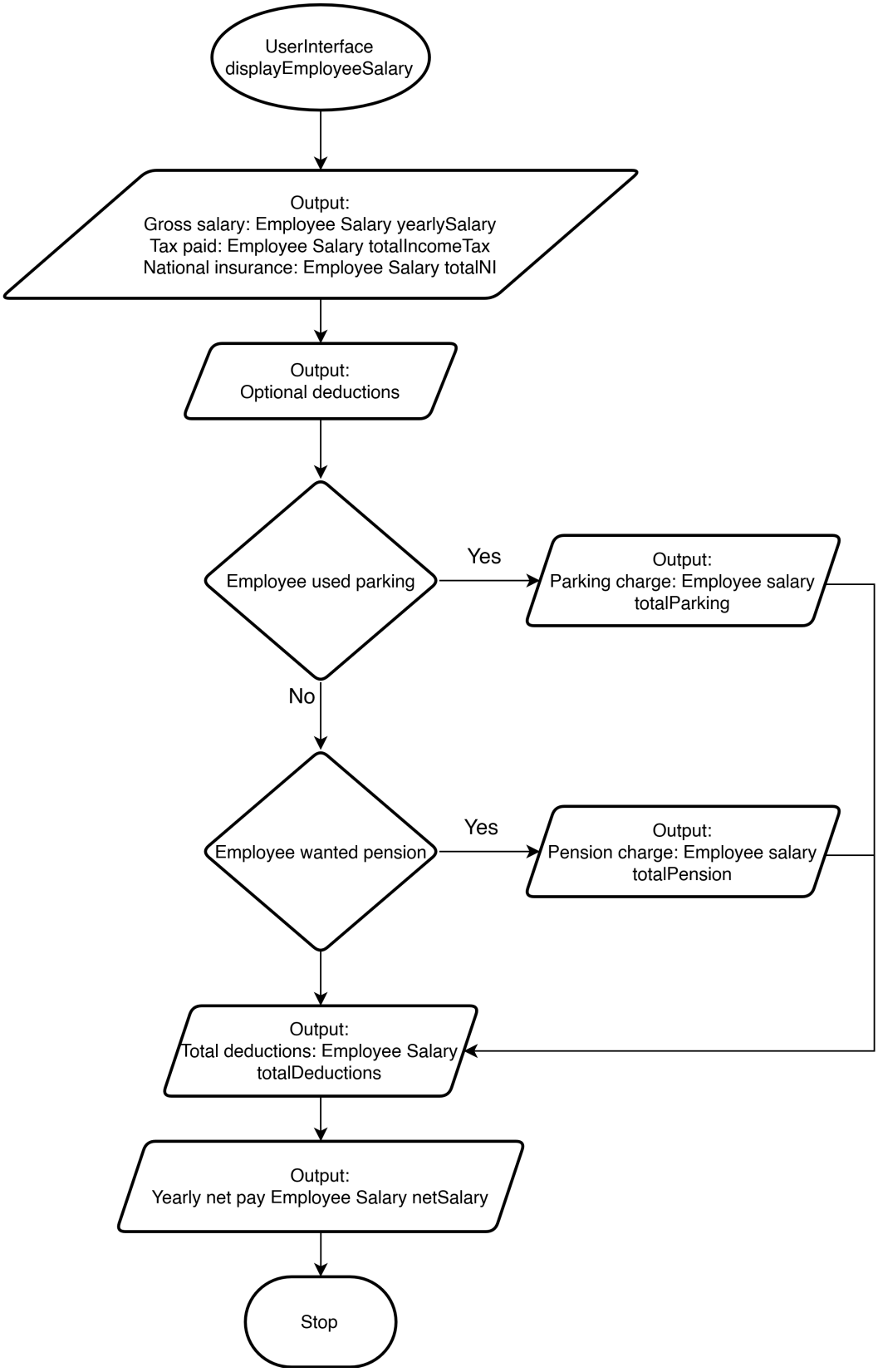

Figure 12: 3rd Flowchart of UserInterface

Design decisions:

Several important design choices were made prior to starting on the flowcharts and program. The following choices were made, salary calculations would be created through a process of test-driven development to ensure that they carried out the correct calculations. This necessitated the use of dependency injection in areas related to input and output as the tests had to be consistent, unaffected by changes to user input or files.

Part B - Programming Task

Part 1 User Login and Unique Pin

Source Code

`Main.java`

```java
package usw.employeelogin;

import java.util.Scanner;

public class Main {
    public static void main(String[] args) {

        Scanner scanner = new Scanner(System.in);
        UserInterface userInput = new UserInterface(scanner);
        userInput.userStart();
    }
}
```

`Employee.java`

```java
package usw.employeelogin;

public class Employee {
    private final String name;
    private final int employeeNum;
    private final int employeeAge;
    private final int pinNum;

    /**
     * Creates an employee
     *
     * @param name        Name of employee
     * @param employeeNum Number employee
     * @param employeeAge Age of employee
```

```
15       */
16      public Employee(String name, int employeeNum, int employeeAge) {
17          this.name = name;
18          this.employeeNum = employeeNum;
19          this.employeeAge = employeeAge;
20          this.pinNum = createPinNum();
21      }
22
23      /**
24       * Internal class that returns code. Used in construction of class
25       *
26       * @return Returns the person's PIN
27       */
28      private int createPinNum() {
29          // Gets the person's PIN
30          // PINs are user's name length multiplied by their age
31          // Modulo prevents pins above 9999
32          String[] firstName = this.name.split(" ");
33          return (firstName[0].length() * employeeAge) % 1000;
34      }
35
36      public String getName() {
37          return name;
38      }
39
40      public int getPinNum() {
41          return pinNum;
42      }
43
44      public int getEmployeeNum() {
45          return employeeNum;
46      }
47  }
```

UserInterface.java

```
1   package usw.employeelogin;
2
3   import java.util.InputMismatchException;
4   import java.util.Scanner;
5
6   public class UserInterface {
7
8       private final Scanner scanner;
9
10      public UserInterface(Scanner scanner) {
11          this.scanner = scanner;
12      }
13
14      public void userStart() {
```

```
15          System.out.println(
16              "Welcome to USW employee management system
17          ");
18
19          String employeeName;
20          int employeeAge;
21          int employeeNumber;
22
23
24          while (true) {
25              System.out.print("Please enter your full name: ");
26              employeeName = scanner.nextLine();
27              if (!employeeName.isEmpty()) {
28                  break;
29              }
30              System.out.println("Empty inputs are not accepted");
31          }
32
33          while (true) {
34              System.out.print("What's your age: ");
35              try {
36                  employeeAge = scanner.nextInt();
37                  if (employeeAge < 0) {
38                      System.out.println(
39                          "Negative ages not allowed"
40                      );
41                      scanner.nextLine();
42                      continue;
43                  }
44                  break;
45              } catch (InputMismatchException e) {
46                  System.out.println(
47                      "Letters not allowed in age"
48                  );
49                  scanner.nextLine();
50              }
51          }
52
53          while (true) {
54              System.out.print("Please enter your employee number: ");
55              try {
56                  employeeNumber = scanner.nextInt();
57                  if (employeeNumber < 0) {
58                      System.out.println(
59                          "Negative employee numbers not allowed"
60                      );
61                      scanner.nextLine();
62                      continue;
63                  }
64                  break;
65              } catch (InputMismatchException e) {
```

```
                System.out.println(
                    "Letters not allowed in employee number"
                );
                scanner.nextLine();
            }
        }

        Employee newEmployee = new Employee(employeeName,
            employeeNumber, employeeAge
        );
        System.out.printf(
            "Hi %s. Your employee account %d has been created.
            Your unique pin number is %04d.",
            newEmployee.getName(),
            newEmployee.getEmployeeNum(),
            newEmployee.getPinNum()
        );
    }
}
```

Program Unit Tests

EmployeeTest.java

```
package usw.employeelogin;

import org.junit.jupiter.api.DisplayName;
import org.junit.jupiter.api.Test;

import static org.junit.jupiter.api.Assertions.assertEquals;

class EmployeeTest {
    Employee testEmployee = new Employee("jim", 330, 20);
    Employee testEmployeeLong = new Employee("12345", 203, 4321);

    @Test
    @DisplayName("Pin number generated correctly")
    public void getPinNum() {
        assertEquals(60, testEmployee.getPinNum());
        assertEquals(605, testEmployeeLong.getPinNum());
    }
}
```

Program Outputs

Running `Main.java` with typical inputs,

```
Welcome to USW employee management system
Please enter your full name: Jake
What's your age: 19
Please enter your employee number: 234212
Hi Jake. Your employee account 234212 has been created. Your unique pin number is 0076.
```

Using longer details,

```
Welcome to USW employee management system
Please enter your full name: Jefferson Jame
What's your age: 34
Please enter your employee number: 43244
Hi Jefferson Jame. Your employee account 43244 has been created. Your unique pin number is 0306.
```

Testing input validation:

Full name,

```
Welcome to USW employee management system
Please enter your full name:
Empty inputs are not accepted
Please enter your full name:
```

Age,

```
Welcome to USW employee management system
Please enter your full name: Jake
What's your age: af
Letters not allowed in age
What's your age:
```

Employee number,

```
Welcome to USW employee management system
Please enter your full name: Jake
What's your age: 43
Please enter your employee number: a
Letters not allowed in employee number
Please enter your employee number:
```

Unit Test Outputs,

```
[INFO] -------------------------------------------------------
[INFO]  T E S T S
[INFO] -------------------------------------------------------
[INFO] Running usw.employeepay.RateIOTest
[INFO] Tests run: 4, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.105 s -- in usw.employeepay.RateIOTest
```

```
[INFO] Running usw.employeepay.UserInterfaceTest
Welcome to USW Employee Salary Calculator
----------------------------------------
Employee Name: Employee number: [INFO] Tests run: 1, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.032 s -- in usw.employeepay.UserInterfaceTest
[INFO] Running usw.employeepay.SalaryTest
[INFO] Tests run: 8, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.034 s -- in usw.employeepay.SalaryTest
[INFO]
[INFO] Results:
[INFO]
[INFO] Tests run: 13, Failures: 0, Errors: 0, Skipped: 0
[INFO]
[INFO] ------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------
[INFO] Total time:  1.859 s
[INFO] Finished at: 2023-12-01T11:10:30Z
[INFO] ------------------------------------------------------------
```

These tests include:

- RateIO
  - CSV tax bands
  - CSV NI bands
  - CSV pension bands
  - CSV parking fee
- Salary
  - Calculate monthly salary
  - Calculate and apply parking charge
  - Calculate taxable amount
  - Calculate total deductions
  - Calculate and apply national insurance
  - Calculate net salary
  - Calculate and apply income tax
  - Calculate and apply teachers pension
- UserInterface
  - Valid input in name field

All tests used the specification examples as test values.

Salary tests use a mock implementation of the interface `iRateIO` based on the coursework specification to avoid failing tests due to a change in the `RateIO` CSV file.

Part 2 - Employee Pay Calculator

Program Source Code

`Main.java`

```java
package usw.employeepay;

import java.io.IOException;
import java.util.Scanner;

public class Main {
    public static void main(String[] args) {
        RateIO rateIO;
        try {
            rateIO = new RateIO("rates.csv");


        } catch (IOException e) {
            System.out.println("File, rates.csv, was not found. Make
                sure rates.csv is run in same folder as the " +
                    "program");
            return;
        }
        Scanner scanner = new Scanner(System.in);
        UserInterface userInput = new UserInterface(scanner);
        Employee employee = userInput.createEmployeeLoop();
        employee.setEmployeeSalary(userInput.getSalaryLoop(rateIO));

        /* Apply income tax and national insurance */
        employee.getSalary().applyMandatoryDeductions();

        /* Check if user wants to apply optional deductions */
        if (userInput.userApplyParking()) {
            employee.getSalary().applyParkingCharge();
        }
        if (userInput.userApplyPension()) {
            employee.getSalary().applyPension();
        }
        UserInterface.displayEmployeeSalary(employee);
    }
}
```

`UserInterface.java`

```java
package usw.employeepay;

import java.math.BigDecimal;
import java.math.RoundingMode;
import java.util.InputMismatchException;
import java.util.Scanner;

public class UserInterface {

    private final Scanner scanner;


    /**
     * Class that handles outputting and accepting user input
     *
     * @param scanner Input handling
     */
    public UserInterface(Scanner scanner) {
        this.scanner = scanner;
    }


    /**
     * Outputs the information concerning an employee's salary
     *
     * @param employee Employee to display salary of
     */
    public static void displayEmployeeSalary(Employee employee) {

        System.out.println("\nCalculating yearly net pay...\n");
        System.out.printf("""
            Gross salary: £%s
            Taxable amount: £%s
            Tax paid: £%s
            National insurance paid: £%s
            """,
            employee.getSalary().getGrossSalary(),
            employee.getSalary().getTaxableAmount(),
            employee.getSalary().getIncomeTaxAmount(),
            employee.getSalary().getNIAmount()
        );

        /* Non-required deductions */
        if (!(employee.getSalary().getTotalParking() == null)) {
            System.out.printf("Parking charge: £%s\n",
                employee.getSalary().getTotalParking()
            );
        }

        if (!(employee.getSalary().getPensionAmount() == null)) {
```

```
51              System.out.printf("Pension charge: £%s\n",
52                  employee.getSalary().getPensionAmount()
53              );
54          }
55
56          System.out.printf("\nTotal deductions: £%s\n",
57              employee.getSalary().getTotalDeductions()
58          );
59          System.out.printf("Yearly net pay: £%s\n",
60              employee.getSalary().getNetSalary()
61          );
62
63
64          System.out.println("\nCalculating monthly net pay...\n");
65          System.out.printf("""
66              Gross salary: £%s
67              Taxable amount: £%s
68              Tax paid: £%s
69              National insurance paid: £%s
70              """,
71              Salary.convertMonthly(
72                  employee.getSalary().getGrossSalary()
73              ),
74              Salary.convertMonthly(
75                  employee.getSalary().getTaxableAmount()
76              ),
77              Salary.convertMonthly(
78                  employee.getSalary().getIncomeTaxAmount()
79              ),
80              Salary.convertMonthly(
81                  employee.getSalary().getNIAmount()
82              )
83          );
84
85
86          /* Non-required deductions */
87          if (!(employee.getSalary().getTotalParking() == null)) {
88              System.out.printf("Parking charge: £%s\n",
89                  Salary.convertMonthly(employee.getSalary().
                        getTotalParking())
90              );
91          }
92
93          if (!(employee.getSalary().getPensionAmount() == null)) {
94              System.out.printf("Pension charge: £%s\n",
95                  Salary.convertMonthly(employee.getSalary().
                        getPensionAmount())
96              );
97          }
98
99          System.out.printf("\nMonthly total deductions: £%s\n",
```

```
100             Salary.convertMonthly(employee.getSalary().
                    getTotalDeductions())
101         );
102
103         System.out.printf("Monthly net pay: £%s\n",
104             employee.getSalary().getMonthlyNetSalary()
105         );
106     }
107
108     /**
109      * UI loop constructs an Employee class and returns it
110      * Uses validation
111      *
112      * @return Constructed Employee object
113      */
114     public Employee createEmployeeLoop() {
115
116         String employeeName;
117         int employeeNumber;
118
119         System.out.println(
120             "Welcome to USW Employee Salary Calculator"
121         );
122         System.out.println(
123             "---------------------------------------"
124         );
125
126         while (true) {
127             System.out.print("Employee Name: ");
128             employeeName = scanner.nextLine();
129             if (!employeeName.isEmpty()) {
130                 break;
131             }
132             System.out.println("Empty inputs are not accepted.");
133         }
134
135         while (true) {
136             System.out.print("Employee number: ");
137             try {
138                 employeeNumber = scanner.nextInt();
139                 if (employeeNumber < 0) {
140                     System.out.println(
141                         "Negative numbers not accepted"
142                     );
143                     continue;
144                 }
145                 break;
146             } catch (InputMismatchException e) {
147                 System.out.println(
148                     "Letter are not allowed employee number"
149                 );
```

```
150                 /* nextLine clears the newline from nextInt() avoiding
151                 duplicates of above message */
152                 scanner.nextLine();
153             }
154         }
155         return new Employee(employeeName, employeeNumber);
156     }
157 
158     /**
159      * UI loop that constructs Salary that is filled with tax
            information
160      *
161      * @param rateIO The tax bands to use in initial instantiation of
            taxes, pension, etc.
162      * @return Constructed Salary object
163      */
164     public Salary getSalaryLoop(RateIO rateIO) {
165 
166         BigDecimal yearSalary;
167 
168         while (true) {
169             System.out.print("Yearly salary: ");
170             try {
171                 String inputSalary = scanner.next();
172                 yearSalary = new BigDecimal(inputSalary);
173                 yearSalary = yearSalary.setScale(2, RoundingMode.
                        HALF_UP);
174                 /* Clear the newline character from scanner buffer
175                  * Otherwise next question would appear twice, as the
176                  * scanner would pick up the leftover newline
177                  */
178                 scanner.nextLine();
179 
180                 // Check if the number is negative
181                 if (yearSalary.compareTo(BigDecimal.ZERO) < 0) {
182                     System.out.println(
183                         "Negative salaries are not accepted"
184                     );
185                     continue;
186                 }
187                 break;
188             } catch (NumberFormatException e) {
189                 System.out.println(
190                     "Letter are not allowed in the employee number"
191                 );
192             }
193         }
194         return new Salary(yearSalary, rateIO);
195     }
196 
197     /**
```

```
198         * Asks user if they want to apply a parking charge
199         *
200         * @return To apply parking charge or not
201         */
202        public boolean userApplyParking() {
203
204            while (true) {
205                System.out.println(
206                    "Do you want to apply a parking charge? (y/n)"
207                );
208                // Normalise characters to lowercase
209                String parkingInput = scanner.nextLine().toLowerCase();
210                switch (parkingInput) {
211                    case "y": {
212                        return true;
213                    }
214                    case "n": {
215                        return false;
216                    }
217                }
218            }
219        }
220
221        /**
222         * Asks the user if they want to apply a teacher's pension
223         *
224         * @return bool indicating to apply pension or not
225         */
226        public boolean userApplyPension() {
227            while (true) {
228                System.out.println(
229                    "Do you want to apply a teachers pension? (y/n)"
230                );
231                // Normalise characters to lowercase
232                String parkingInput = scanner.nextLine().toLowerCase();
233                switch (parkingInput) {
234                    case "y": {
235                        return true;
236                    }
237                    case "n": {
238                        return false;
239                    }
240                }
241            }
242        }
243    }
```

Employee.java

```
1   package usw.employeepay;
```

```java

public class Employee {

    private final int employeeNum;
    private final String name;
    private Salary employeeSalary;

    /**
     * Creates employee
     *
     * @param name        Employee name
     * @param employeeNum Employee number
     */
    public Employee(String name, int employeeNum) {
        this.name = name;
        this.employeeNum = employeeNum;
    }

    public String getName() {
        return name;
    }

    public int getEmployeeNum() {
        return employeeNum;
    }

    public Salary getSalary() {
        return employeeSalary;
    }

    /**
     * Adds Salary to Employee
     *
     * @param employeeSalary Salary object
     */
    public void setEmployeeSalary(Salary employeeSalary) {
        this.employeeSalary = employeeSalary;
    }
}
```

Salary.java

```java
package usw.employeepay;

import java.math.BigDecimal;
import java.math.RoundingMode;
import java.util.LinkedHashMap;
import java.util.Map;

/**
```

```java
 * Class that contains information and methods related to Salary.
 * Includes: income tax, national insurance, pensions, and
 * parking charges
 */
public class Salary {

    iRateIO rateIO;

    /*
     * BigDecimal used as we are working with money
     * Avoids errors concerning floating-point representation
     */
    private BigDecimal grossSalary;
    private BigDecimal netSalary;
    private BigDecimal totalDeductions = new BigDecimal("0");
    private BigDecimal totalIncomeTax;
    private BigDecimal totalNI;
    private BigDecimal totalPension;
    private BigDecimal totalParking;

    public Salary(BigDecimal grossSalary, iRateIO rateIO) {
        this.grossSalary = grossSalary;
        netSalary = grossSalary;
        this.rateIO = rateIO;
    }

    public static BigDecimal convertMonthly(BigDecimal amount) {
        return amount.divide(new BigDecimal("12"), 2, RoundingMode.
            HALF_UP);
    }

    /**
     * Applies required deductions: income tax, national insurance
     */
    public void applyMandatoryDeductions() {
        applyIncomeTax();
        applyNationalInsurance();
    }

    public void applyIncomeTax() {
        totalIncomeTax = applyPaymentBands(grossSalary,
            rateIO.getTaxBands()
        );
        totalDeductions = totalDeductions.add(totalIncomeTax);
        netSalary = netSalary.subtract(totalIncomeTax);
    }

    public void applyNationalInsurance() {
        totalNI = applyPaymentBands(grossSalary,
            rateIO.getNationalInsurance()
        );
```

```
59          totalDeductions = totalDeductions.add(totalNI);
60          netSalary = netSalary.subtract(totalNI);
61      }
62
63      public void applyPension() {
64          totalPension = applyPaymentBands(grossSalary,
65              rateIO.getPensionBands()
66          );
67          totalDeductions = totalDeductions.add(totalPension);
68          netSalary = netSalary.subtract(totalPension);
69      }
70
71      public void applyParkingCharge() {
72          // Monthly parking * 12
73          totalParking = rateIO.getMonthlyParking().multiply(
74              new BigDecimal("12")
75          );
76          totalDeductions = totalDeductions.add(totalParking);
77          netSalary = netSalary.subtract(totalParking);
78      }
79
80      /**
81       * Applies payment bands to income dynamically
82       *
83       * @param income       Accepts BigDecimals, no negatives
84       * @param paymentBands LinkedHashMap containing, the taxBand first,
85       *                     then the taxRate, overflow tax rates
86       *                     should be denoted with a negative
87       *                     on the band
88       * @return Total payment on income after paymentBands applied
89       */
90      private BigDecimal applyPaymentBands(BigDecimal income,
            LinkedHashMap<BigDecimal, BigDecimal> paymentBands) {
91
92          BigDecimal totalPayment = new BigDecimal("0");
93          BigDecimal previousBracket = new BigDecimal("0");
94
95          for (Map.Entry<BigDecimal, BigDecimal> entry : paymentBands.
                entrySet()) {
96              BigDecimal currentBracket = entry.getKey();
97              BigDecimal bracketRate = entry.getValue;
98
99              /*
100              * If the payment is in a band denoted with a negative
101              * number then it is overflow, and applies
102              * that rate to rest of salary
103              */
104             if (currentBracket.compareTo(BigDecimal.ZERO) < 0) {
105                 /* totalPayment = totalPayment +
106                  * (income - previousBand) * taxRate
107                  */
```

```
108                 totalPayment = totalPayment.add(
109                     income.subtract(previousBracket).multiply(
                           bracketRate).setScale(2,RoundingMode.HALF_UP)
110                 );
111             } else if (income.compareTo(entry.getKey()) > 0) {
112                 /* If the income is greater than the current
113                  * payment band
114                  */
115
116                 /* totalPayment = totalPayment +
117                  * (currentBracket - previousBand) * taxRate
118                  * It then rounds to 2 decimal places
119                  */
120                 totalPayment = totalPayment.add((
121                     entry.getKey().subtract(previousBracket)).multiply(
122                         entry.getValue()).setScale(2, RoundingMode.
                               HALF_UP)
123                 );
124
125             } else if ((income.compareTo(previousBracket) > 0) && (
                    income.compareTo(entry.getKey()) < 0)) {
126                 /* If the income is smaller than the current payment
127                  * band
128                  */
129
130                 /* Get the leftover money in the band */
131                 BigDecimal bracketAmount = income.subtract(
                       previousBracket);
132                 /* apply tax to the leftover amount in the band
133                  * totalPayment = totalPayment +
134                  * (leftoverAmount * taxRate)
135                  */
136                 totalPayment = totalPayment.add(
137                     bracketAmount.multiply(entry.getValue()).setScale
                           (2, RoundingMode.HALF_UP)
138                 );
139                 /* Since income is smaller than current band, won't
140                  * make it to next band, break out of loop
141                  */
142                 break;
143             }
144             previousBracket = entry.getKey();
145         }
146         return totalPayment;
147     }
148
149     public void setSalary(BigDecimal grossSalary) {
150         this.grossSalary = grossSalary;
151         netSalary = grossSalary;
152         applyMandatoryDeductions();
153     }
```

```
154
155     public void setRateIO(iRateIO rateIO) {
156         this.rateIO = rateIO;
157         applyMandatoryDeductions();
158     }
159
160     public BigDecimal getGrossSalary() {
161         return grossSalary;
162     }
163
164     public BigDecimal getMonthlySalary() {
165         return convertMonthly(grossSalary);
166     }
167
168     public BigDecimal getTaxableAmount() {
169         return grossSalary.subtract(new BigDecimal("12570"));
170     }
171
172     public BigDecimal getIncomeTaxAmount() {
173         return totalIncomeTax;
174     }
175
176     public BigDecimal getNIAmount() {
177         return totalNI;
178     }
179
180     public BigDecimal getPensionAmount() {
181         return totalPension;
182     }
183
184     public BigDecimal getTotalParking() {
185         return totalParking;
186     }
187
188     public BigDecimal getTotalDeductions() {
189         return totalDeductions;
190     }
191
192     public BigDecimal getNetSalary() {
193         return netSalary;
194     }
195
196     public BigDecimal getMonthlyNetSalary() {
197         return netSalary.divide(
198             new BigDecimal("12"), 2, RoundingMode.HALF_UP
199         );
200     }
201 }
```

iRateIO.java

```java
package usw.employeepay;

import java.math.BigDecimal;
import java.util.LinkedHashMap;

/**
 * Interface for RateIO. Multiple implementations that use file
 * reading, and mocked set values for testing purposes
 */
public interface iRateIO {
    LinkedHashMap<BigDecimal, BigDecimal> getTaxBands();

    LinkedHashMap<BigDecimal, BigDecimal> getNationalInsurance();

    LinkedHashMap<BigDecimal, BigDecimal> getPensionBands();

    BigDecimal getMonthlyParking();
}
```

RateIO.java

```java
package usw.employeepay;

import java.io.IOException;
import java.math.BigDecimal;
import java.nio.file.Files;
import java.nio.file.Paths;
import java.util.Arrays;
import java.util.LinkedHashMap;
import java.util.List;

public class RateIO implements iRateIO {
    private final LinkedHashMap<BigDecimal, BigDecimal> taxBands = new
        LinkedHashMap<>();
    private final LinkedHashMap<BigDecimal, BigDecimal> pensionBands =
        new LinkedHashMap<>();
    private final LinkedHashMap<BigDecimal, BigDecimal>
        nationalInsurance = new LinkedHashMap<>();
    private BigDecimal monthlyParking;

    /**
     * Reads a CSV for tax bands, national insurance, and
     * @param filePath String of file path
     * @throws IOException If file does not exist / is not found
     */
    public RateIO(String filePath) throws IOException {
        List<String> lines = Files.readAllLines(Paths.get(filePath));
        // Each line runs the parseLine function
        lines.forEach(line ->
```

```
26                  parseLine(Arrays.asList(line.split(",")))
27              );
28          }
29
30          /**
31           * Handle the separated line and add it to a tax band
32           * @param line Line to parse
33           */
34          private void parseLine(List<String> line) {
35              /* Each type of deduction possible in CSV */
36              switch (line.get(0)) {
37                  case "tax" -> taxBands.put(
38                      new BigDecimal(line.get(1)),
39                      new BigDecimal(line.get(2))
40                  );
41                  case "pension" -> pensionBands.put(
42                      new BigDecimal(line.get(1)),
43                      new BigDecimal(line.get(2))
44                  );
45                  case "nationalInsurance" -> nationalInsurance.put(
46                      new BigDecimal(line.get(1)),
47                      new BigDecimal(line.get(2))
48                  );
49                  case "parking" -> monthlyParking = (
50                      new BigDecimal(line.get(1))
51                  );
52              }
53          }
54
55          public LinkedHashMap<BigDecimal, BigDecimal> getTaxBands() {
56              return taxBands;
57          }
58
59          public LinkedHashMap<BigDecimal, BigDecimal> getNationalInsurance()
                {
60              return nationalInsurance;
61          }
62
63          public LinkedHashMap<BigDecimal, BigDecimal> getPensionBands() {
64              return pensionBands;
65          }
66
67          public BigDecimal getMonthlyParking() {
68              return monthlyParking;
69          }
70      }
```

Program Unit Tests

SalaryTest.java

```java
package usw.employeepay;

import org.junit.jupiter.api.DisplayName;
import org.junit.jupiter.api.Test;

import java.math.BigDecimal;

import static org.junit.jupiter.api.Assertions.assertEquals;

class SalaryTest {

    TestingFakeRateIO testingRateIO = new TestingFakeRateIO();
    Salary testSalary = new Salary(
        new BigDecimal("45000"), testingRateIO
    );
    Salary testSalaryDecimal = new Salary(
        new BigDecimal("50000"), testingRateIO
    );
    Salary testSalaryLarge = new Salary(
        new BigDecimal("140000"), testingRateIO)
    ;

    @Test
    @DisplayName("Calculate monthly salary")
    public void monthlySalaryCalculations() {
        BigDecimal expectedMonthlySalary2 = new BigDecimal("3750");

        assertEquals(0, expectedMonthlySalary2.compareTo(
            testSalary.getMonthlySalary())
        );

        BigDecimal expectedMonthlySalary1 = new BigDecimal("4166.67");

        assertEquals(0, expectedMonthlySalary1.compareTo(
            testSalaryDecimal.getMonthlySalary())
        );

    }

    @Test
    @DisplayName("Calculate taxable amount")
    public void getTaxableAmount() {
        BigDecimal expectedTaxableAmount = new BigDecimal("32430.00");

        assertEquals(0, expectedTaxableAmount.compareTo(
            testSalary.getTaxableAmount())
        );
```

```
48      }
49
50      @Test
51      @DisplayName("Calculate income tax")
52      public void calculateIncomeTax() {
53          BigDecimal expectedTax = new BigDecimal("6486");
54          testSalary.applyIncomeTax();
55
56          assertEquals(0, expectedTax.compareTo(
57              testSalary.getIncomeTaxAmount())
58          );
59
60          BigDecimal expectedTaxLarge = new BigDecimal("44175");
61          testSalaryLarge.applyIncomeTax();
62
63          assertEquals(0, expectedTaxLarge.compareTo(
64              testSalaryLarge.getIncomeTaxAmount())
65          );
66      }
67
68      @Test
69      @DisplayName("Calculate national insurance")
70      void calculateNationalInsurance() {
71          BigDecimal expectedNI = new BigDecimal("4251.84");
72          testSalary.applyNationalInsurance();
73
74          assertEquals(0, expectedNI.compareTo(
75              testSalary.getNIAmount())
76          );
77      }
78
79      @Test
80      @DisplayName("Parking charge applies")
81      void useParkingCharge() {
82          BigDecimal expectedNetSalary = new BigDecimal("34142.16");
83          BigDecimal monthlyParking = new BigDecimal("120.00");
84          testSalary.applyMandatoryDeductions();
85          testSalary.applyParkingCharge();
86
87          assertEquals(0, monthlyParking.compareTo(
88              testSalary.getTotalParking())
89          );
90          assertEquals(0, expectedNetSalary.compareTo(
91              testSalary.getNetSalary())
92          );
93      }
94
95      @Test
96      @DisplayName("Total teachers pension")
97      void getTotalTeachersPension() {
98          BigDecimal expectedTeachersPension = new BigDecimal("3501.76");
```

```
99          testSalary.applyPension();
100
101         assertEquals(0, expectedTeachersPension.compareTo(
102             testSalary.getPensionAmount())
103         );
104     }
105
106     @Test
107     @DisplayName("Total deductions")
108     void getTotalDeductions() {
109         BigDecimal expectedDeductions = new BigDecimal("10737.84");
110         testSalary.applyMandatoryDeductions();
111
112         assertEquals(0, expectedDeductions.compareTo(
113             testSalary.getTotalDeductions())
114         );
115     }
116
117     @Test
118     @DisplayName("Net salary")
119     void getNetSalary() {
120         BigDecimal expectedNetSalary = new BigDecimal("34142.16");
121         testSalary.applyMandatoryDeductions();
122         testSalary.applyParkingCharge();
123
124         assertEquals(0, expectedNetSalary.compareTo(
125             testSalary.getNetSalary())
126         );
127     }
128 }
```

RateIOTest.java

```
1
2  package usw.employeepay;
3
4  import org.junit.jupiter.api.BeforeEach;
5  import org.junit.jupiter.api.DisplayName;
6  import org.junit.jupiter.api.Test;
7
8  import java.io.IOException;
9  import java.math.BigDecimal;
10 import java.util.LinkedHashMap;
11
12 import static org.junit.jupiter.api.Assertions.assertEquals;
13
14 class RateIOTest {
15     private RateIO rateIO;
16
17     @BeforeEach
```

```
18      void setUp() {
19          try {
20              rateIO = new RateIO("rates.csv");
21
22          } catch (IOException e) {
23              System.out.println(e);
24          }
25      }
26
27      @Test
28      @DisplayName("CSV tax bands")
29      void getTaxBands() {
30          LinkedHashMap<BigDecimal, BigDecimal> expectedTaxBands = new
                LinkedHashMap<>();
31          expectedTaxBands.put(
32              new BigDecimal("12570"), new BigDecimal("0.00")
33          );
34          expectedTaxBands.put(
35              new BigDecimal("50270"), new BigDecimal("0.20")
36          );
37          expectedTaxBands.put(
38              new BigDecimal("125140"), new BigDecimal("0.40")
39          );
40          expectedTaxBands.put(
41              new BigDecimal("-1"), new BigDecimal("0.45")
42          );
43          assertEquals(expectedTaxBands, rateIO.getTaxBands());
44      }
45
46      @Test
47      @DisplayName("NI tax bands")
48      void getNationalInsurance() {
49          LinkedHashMap<BigDecimal, BigDecimal> expectedNationalInsurance
                = new LinkedHashMap<>();
50          expectedNationalInsurance.put(
51              new BigDecimal("9568"), new BigDecimal("0.00")
52          );
53          expectedNationalInsurance.put(
54              new BigDecimal("-1"), new BigDecimal("0.12")
55          );
56          assertEquals(expectedNationalInsurance, rateIO.
                getNationalInsurance());
57      }
58
59      @Test
60      @DisplayName("Pension tax bands")
61      void getPensionBands() {
62          LinkedHashMap<BigDecimal, BigDecimal> expectedPensionBands =
                new LinkedHashMap<>();
63
64          expectedPensionBands.put(
```

```
65                  new BigDecimal("32135.99"), new BigDecimal("0.074")
66              );
67              expectedPensionBands.put(
68                  new BigDecimal("43259.99"), new BigDecimal("0.086")
69              );
70              expectedPensionBands.put(
71                  new BigDecimal("51292.99"), new BigDecimal("0.096")
72              );
73              expectedPensionBands.put(
74                  new BigDecimal("67980.99"), new BigDecimal("0.102")
75              );
76              expectedPensionBands.put(
77                  new BigDecimal("92597.99"), new BigDecimal("0.113")
78              );
79              expectedPensionBands.put(
80                  new BigDecimal("-1"), new BigDecimal("0.117")
81              );
82              assertEquals(expectedPensionBands, rateIO.getPensionBands());
83          }
84
85          @Test
86          @DisplayName("CSV parking fee")
87          void getMonthlyParking() {
88              BigDecimal expectedMonthlyParking = new BigDecimal("10.00");
89              assertEquals(0, expectedMonthlyParking.compareTo(
90                  rateIO.getMonthlyParking())
91              );
92          }
93      }
```

UserInterfaceTest.java

```
1   package usw.employeepay;
2
3   import org.junit.jupiter.api.DisplayName;
4   import org.junit.jupiter.api.Test;
5
6   import java.io.ByteArrayInputStream;
7   import java.util.Scanner;
8
9   class UserInterfaceTest {
10
11      @Test
12      @DisplayName("Valid input in name field")
13      void nameValidInput() {
14
15          String dataIn = "Jake Real\n4324324\n423432";
16          ByteArrayInputStream in = new ByteArrayInputStream(
17              dataIn.getBytes()
18          );
```

```
        System.setIn(in);

        Scanner scanner = new Scanner(System.in);

        UserInterface userInput = new UserInterface(scanner);
        userInput.createEmployeeLoop();
    }
}
```

Program Outputs

Running, `Main.java` with typical inputs,

```
Welcome to USW Employee Salary Calculator
----------------------------------------
Employee Name: jake
Employee number: 43232
Yearly salary: 45000
45000.00
Do you want to apply a parking charge? (y/n)
n
Do you want to apply a teachers pension? (y/n)
n

Calculating yearly net pay...

Gross salary: £45000.00
Taxable amount: £32430.00
Tax paid: £6486.00
National insurance paid: £4251.84

Total deductions: £10737.84
Yearly net pay: £34262.16

Calculating monthly net pay...

Gross salary: £3750.00
Taxable amount: £2702.50
Tax paid: £540.50
National insurance paid: £354.32

Monthly total deductions: £894.82
Monthly net pay: £2855.18
```

Testing input validation:

Employee number,

```
Welcome to USW Employee Salary Calculator
```

```
----------------------------------------
Employee Name: Jake
Employee number: -3242
Negative numbers not accepted
Employee number:
```

Salary,

```
Welcome to USW Employee Salary Calculator
----------------------------------------
Employee Name: Jake
Employee number: 5000
Yearly salary: -2
Negative salaries are not accepted
Yearly salary:
```

Unit Test Outputs,

```
[INFO] -------------------------------------------------------
[INFO]  T E S T S
[INFO] -------------------------------------------------------
[INFO] Running usw.employeelogin.EmployeeTest
[INFO] Tests run: 1, Failures: 0, Errors: 0, Skipped: 0, Time elapsed:
   0.063 s - in usw.employeelogin.EmployeeTest
[INFO]
[INFO] Results:
[INFO]
[INFO] Tests run: 1, Failures: 0, Errors: 0, Skipped: 0
[INFO]
[INFO]
[INFO] --- jar:3.3.0:jar (default-jar) @ pop-coursework ---
[INFO] Building jar: /home/jake/Code/usw/pop-coursework-1/target/pop-
   coursework-1.0-SNAPSHOT.jar
[INFO] -------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] -------------------------------------------------------
[INFO] Total time:  3.098 s
[INFO] Finished at: 2023-12-08T17:37:55Z
[INFO] -------------------------------------------------------
```

These tests include:

- RateIO
  - CSV tax bands
  - CSV NI bands
  - CSV pension bands
  - CSV parking fee
- Salary

  - Calculate monthly salary
  - Calculate and apply parking charge
  - Calculate taxable amount
  - Calculate total deductions
  - Calculate and apply national insurance
  - Calculate net salary
  - Calculate and apply income tax
  - Calculate and apply teachers pension

- UserInterface
  - Valid input in name field

All tests used the specification examples as test values.

Salary tests use a mock implementation of the interface `iRateIO` based on the coursework specification to avoid failing tests due to a change in the `RateIO` CSV file.

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