1

```
// Refactor 1: Handled empty input string at the beginning.
        public int Add(String numbers) {
           if (numbers.isEmpty()) { return 0; }
        }

// Refactor 2: Made the code concise by directly returning the single number.
        public int Add(String numbers) {
           if (numbers.isEmpty()) { return 0; }
           int number = Integer.parseInt(numbers);
           return number;
        }

// Refactor 3: Optimized for two numbers, no need for splitting and iteration.
        public int Add(String numbers) {
           if (numbers.isEmpty()) { return 0; }
           String[] nums = numbers.split(",");
           int num1 = Integer.parseInt(nums[0]);
           int num2 = Integer.parseInt(nums[1]);
           return num1 + num2;
        }

// Refactor 4: Code can handle an unknown number of arguments efficiently.
        public int Add(String numbers) {
           if (numbers.isEmpty()) { return 0; }
           String[] nums = numbers.split(",");
           int sumOfNumbers = 0;
           for (String num : nums) { sumOfNumbers += Integer.parseInt(num); }
           return sumOfNumbers;
        }

// Refactor 5: Code can handle null inputs and newline charaters “\n”
        public class AddMyAlphas {
           public int Add (String numbers) {
              if (numbers == null || numbers.isEmpty()) { return 0; }
              String[] nums = numbers.split("[,\n]");
              int sumOfNumbers = 0;
              for (String num : nums) { sumOfNumbers += Integer.parseInt(num); }
              return sumOfNumbers;
           }
        }
```

```
// Refactor 6: Adding a method for Integer Parsing and creating a bucket of negative integers
// and returning an error with elements in the bucket (if exists)
public class AddMyAlphas {
   public int Add (String numbers) {
      if (numbers== null || numbers.isEmpty()) { return 0; }
      String[] nums = numbers.split("[,\n]");
      int sumOfNumbers = 0;
      List<Integer> negativeNumbers = new ArrayList<Integer>();

      for (String num : nums) {
         int currentNumber = Integer.parseInt(num);
         if (currentNumber < 0) { negativeNumbers.add(currentNumber); }
         sumOfNumbers += currentNumber;
      }
      if (!negativeNumbers.isEmpty()) {
         throw new IllegalArgumentException("Negatives not allowed: " + negativeNumbers);
      }
      return sumOfNumbers;
   }
}

// Refactor 7:  Adding a check for avoiding numbers more than 1000
public class AddMyAlphas {
   public int Add (String numbers) {
      if (numbers== null || numbers.isEmpty()) { return 0; }
      String[] nums = numbers.split("[,\n]");
      int sumOfNumbers = 0;
      List<Integer> negativeNumbers = new ArrayList<Integer>();

      for (String num : nums) {
         int currentNumber = Integer.parseInt(num);
         if (currentNumber < 0) { negativeNumbers.add(currentNumber); }
         else if (currentNumber > 1000) continue;
         sumOfNumbers += currentNumber;
      }
      if (!negativeNumbers.isEmpty())
{ throw new IllegalArgumentException("Negatives not allowed: " + negativeNumbers); }
      return sumOfNumbers;
   }
}
```

```
// Refactor 8: Checking delimiters after “//” and before “\n”, and splitting the strings
// into numbers and parsing Integer values from it. Default delimiter is “,”.
public class AddMyAlphas {
   public int Add(String numbers) {
      if (numbers== null || numbers.isEmpty()) { return 0; }

      String delimiter = ",";
      String numbersPart = numbers;

      if (numbers.startsWith("//")) { // Check for custom delimiter
         int delimiterIndex = numbers.indexOf("\n"); // Find newline after delimiter
         delimiter = numbers.substring(2, delimiterIndex); // Extract custom delimiter
         numbersPart = numbers.substring(delimiterIndex + 1); // Extract numbers part
      }

      String[] nums = numbersPart.split("[,\n" + delimiter + "]");
                                    // Split numbers using delimiter(s)
      int sumOfNumbers = 0;
      List<Integer> negatives = new ArrayList<>();

      for (String num : nums) {
         int currentNumber = Integer.parseInt(num);
         if (currentNumber < 0) { negatives.add(currentNumber); }
         else if (currentNumber <= 1000) { sumOfNumbers += currentNumber; }
      }
      if (!negatives.isEmpty())
          { throw new IllegalArgumentException("Negatives not allowed: " + negatives); }

      return sumOfNumbers;
   }
}
```

QUESTION 1 CAN BE FOUND ON JUNIT TEST FOLDER

MAIN FINAL FILE

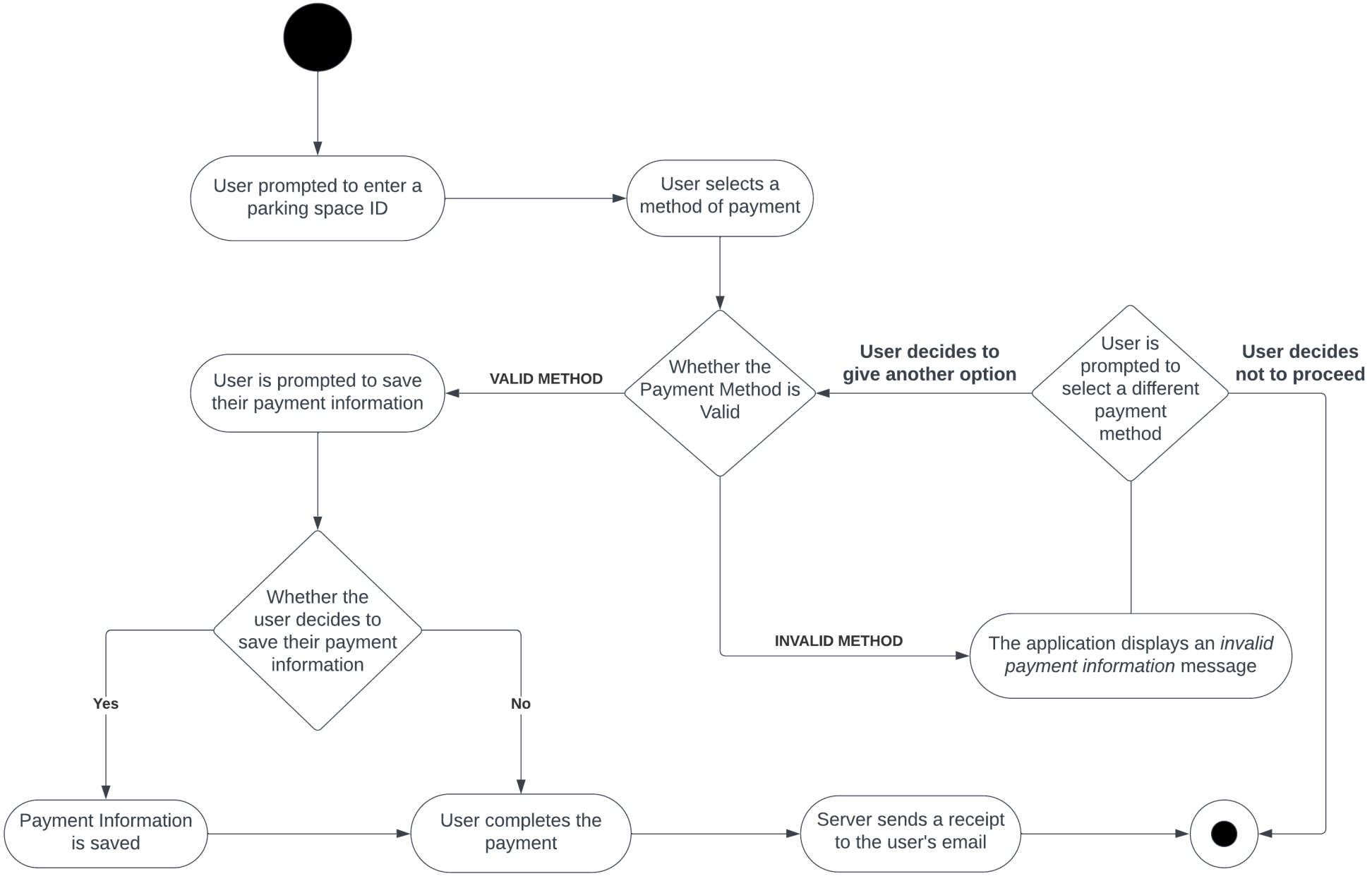
```
package assignment2;

import java.util.ArrayList;
import java.util.List;

public class AddMyAlphas {
   public int Add(String numbers) {
      if (numbers== null || numbers.isEmpty()) { return 0; }

      String delimiter = ",";
      String numbersPart = numbers;

      if (numbers.startsWith("//")) { // Check for custom delimiter
         int delimiterIndex = numbers.indexOf("\n"); // Find newline after delimiter
         delimiter = numbers.substring(2, delimiterIndex); // Extract custom delimiter
         numbersPart = numbers.substring(delimiterIndex + 1); // Extract numbers part
      }

      String[] nums = numbersPart.split("[,\n" + delimiter + "]"); // Split numbers using
delimiter(s)
      int sumOfNumbers = 0;
      List<Integer> negatives = new ArrayList<>();

      for (String num : nums) {
         int currentNumber = Integer.parseInt(num);
         if (currentNumber < 0) { negatives.add(currentNumber); }
         else if (currentNumber <= 1000) { sumOfNumbers += currentNumber; }
      }
      if (!negatives.isEmpty()) { throw new IllegalArgumentException("Negatives not allowed: " +
negatives); }

      return sumOfNumbers;
   }
}
```

MAIN FINAL TEST FILE

```
package assignment2;

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

public class AddMyAlphasTest {
   @Test
   public void AddMyAlphaTest01_Q1_EmptyString()
{
      AddMyAlphas adder = new AddMyAlphas();
      int result = adder.Add("");
      assertEquals(0, result);
   }

   @Test
   public void AddMyAlphaTest02_Q1_OneDigits() {
      AddMyAlphas adder = new AddMyAlphas();
      int result = adder.Add("1");
      assertEquals(1, result);
   }

   @Test
   public void AddMyAlphaTest03_Q1_TwoDigits() {
      AddMyAlphas adder = new AddMyAlphas();
      int result = adder.Add("1,4");
      assertEquals(5, result);
   }

   @Test
   public void
AddMyAlphaTest04_Q2_MultipleDigits() {
      AddMyAlphas adder = new AddMyAlphas();
      int result =
adder.Add("1,3,5,7,9,11,13,15,17,19");
      assertEquals(100, result);
   }

   @Test
   public void
AddMyAlphaTest05_Q3_DoubleNewLineTest() {
      AddMyAlphas adder = new AddMyAlphas();
      int result = adder.Add("1\n2,3");
      assertEquals(6, result);
   }

   @Test
   public void
AddMyAlphaTest06_Q4_MultipleNegativeNumbers()
{
      AddMyAlphas adder = new AddMyAlphas();
      Exception exception =
assertThrows(IllegalArgumentException.class, () -> {
         adder.Add("2,-4,3,-5");
      });
      assertEquals("Negatives not allowed: [-4, -5]",
exception.getMessage());
   }

   @Test
   public void
AddMyAlphaTest07_Q5_NumbersBiggerNumbers() {
      AddMyAlphas adder = new AddMyAlphas();
      int result = adder.Add("1,2\n2000\n3000");
      assertEquals(3, result);
   }
   @Test
   public void
AddMyAlphaTest08_Q6_CustomDelimiterSemicolon(
) {
      AddMyAlphas adder = new AddMyAlphas();
      int result = adder.Add("//;\n1;2");
      assertEquals(3, result);
   }

   @Test
   public void
AddMyAlphaTest09_Q6_CustomDelimiterPipe() {
      AddMyAlphas adder = new AddMyAlphas();
      int result = adder.Add("//\\|\n1|2|3");
      assertEquals(6, result);
   }
```

```
    @Test
    public void AddMyAlphaTest10_Q6_CustomDelimiterDollar() {
        AddMyAlphas adder = new AddMyAlphas();
        int result = adder.Add("//$\n1$2$3$4$5");
        assertEquals(15, result);
    }
}
```

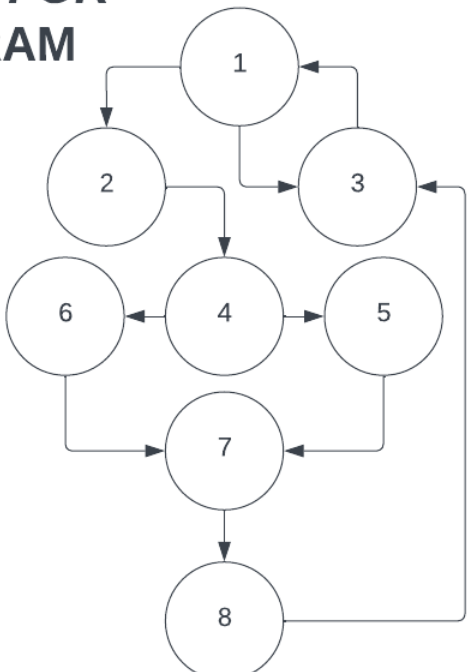
2A ACTIVITY DIAGRAM FOR *PAY FOR PARKING SPACE* USE CASE



2B GRAPH GENERATED FROM *PAY FOR PARKING SPACE* ACTIVITY DIAGRAM

NODE | ACTIONS

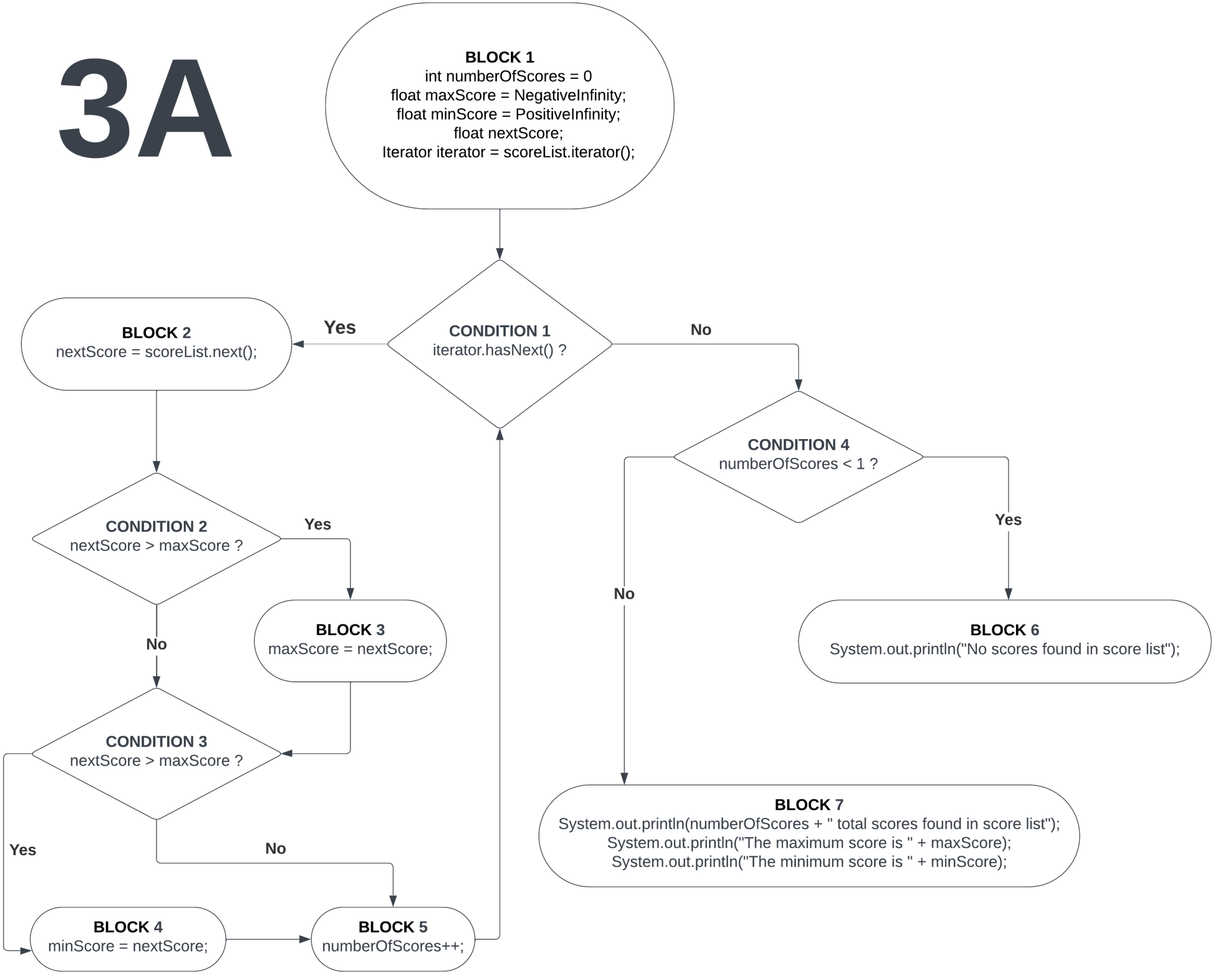
- 1 | User enters payment information
- 2 | User selects a right method of payment
- 3 | User selects a wrong method of payment
- 4 | User is prompted to save payment information
- 5 | User decides to save their payment information
- 6 | User decides not to save their payment information
- 7 | Server sends a payment receipt to user
- 8 | User completes the input process



2C

PATH	1-2-4-5-7-8	1-3-1-2-5-7-8	1-3-1-3-8	1-2-4-6-7-8
INITIAL CONDITIONS	User enters a parking space ID and is prompted to input a payment information	User enters a parking space ID and is prompted to input a payment information	User enters a parking space ID and is prompted to input a payment information	User enters a parking space ID and is prompted to input a payment information
TEST STEPS	1. User enters a parking space ID. 2. User selects a right method of payment. 3. User decides to save their payment information.	1. User enters a parking space ID. 2. User selects a wrong method of payment. 3. User decides to proceed and enters a correct payment method. 4. User decides to save their payment information.	1. User enters a parking space ID. 2. User selects a wrong method of payment. 3. User decides to proceed and enters a wrong payment information again. 4. User decides not to proceed further.	1. User enters a parking space ID. 2. User selects a right method of payment. 3. User decides to NOT save their payment information.
EXPECTED RESULT	Server sends a payment receipt to the user.	Server sends a payment receipt to the user.	No data is sent to the user and the server.	Server sends a payment receipt to the user.

3A


BLOCK 1
int numberOfScores = 0
float maxScore = NegativeInfinity;
float minScore = PositiveInfinity;
float nextScore;
Iterator iterator = scoreList.iterator();
CONDITION 1
iterator.hasNext() ?
Yes
No
BLOCK 2
nextScore = scoreList.next();
CONDITION 2
nextScore > maxScore ?
Yes
No
BLOCK 3
maxScore = nextScore;
CONDITION 3
nextScore > maxScore ?
Yes
No
BLOCK 4
minScore = nextScore;
BLOCK 5
numberOfScores++;
CONDITION 4
numberOfScores < 1 ?
Yes
No
BLOCK 6
System.out.println("No scores found in score list");
BLOCK 7
System.out.println(numberOfScores + " total scores found in score list");
System.out.println("The maximum score is " + maxScore);
System.out.println("The minimum score is " + minScore);

3C

STATEMENT COVERAGE

1. Test Case 1: Empty List
- Input: an empty list
- Expected Output: "No scores found in score list"

2. Test Case 2: List with a single score
- Input: [90]
- Expected Output:
  - "1 total score found in score list"
  - "The maximum score is 90.0"
  - "The minimum score is 90.0"

3. Test Case 3: List with multiple scores
- Input: [75, 85, 95, 80, 70]
- Expected Output:
  - "5 total scores found in score list"
  - "The maximum score is 95.0"
  - "The minimum score is 70.0"

4. Test Case 4: List with negative scores
- Input: [-10, -5, -15, -2]
- Expected Output:
  - "4 total scores found in score list"
  - "The maximum score is -2.0"
  - "The minimum score is -15.0"

BRANCH COVERAGE

1. Test Case 1: Empty List
- Input: an empty list
- Expected Output: "No scores found in score list"

2. Test Case 2: List with a single score
- Input: [90]
- Expected Output:
  - "1 total score found in score list"
  - "The maximum score is 90.0"
  - "The minimum score is 90.0"

3. Test Case 3: List with multiple scores (maxScore > minScore branch)
- Input: [75, 85, 95, 80, 70]
- Expected Output:
  - "5 total scores found in score list"
  - "The maximum score is 95.0"
  - "The minimum score is 70.0"

4. Test Case 4: List with multiple scores (minScore >= maxScore branch)
- Input: [80, 85, 90, 85, 80]
- Expected Output:
  - "5 total scores found in score list"
  - "The maximum score is 90.0"
  - "The minimum score is 80.0"