Lab1

March 20, 2025

1 Lab 1

Deadline: **Week 2** in your respective lab session

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1.1 Question 1 [1 mark]

Write a full Java program (meaning a class that contains a main method) that asks the user for their average percentage across all modules and then prints out their classification: `1st`, `2:1`, `2:2`, `3rd`, `Pass` or `Fail`.

Click here to see the degree class boundaries.

Example runs:
What is your average percentage? 67
Congratulations! You are on a track to graduate with a 2:1!

What is your average percentage? 38
Unfortunately, your current classification is a Fail.

Write your answer below:

```java
[6]: import java.util.Scanner;

public class UniversityGrading
{
        public static void main(String[] args)
        {
                //ask question
                int percentage = inputInt("What is your average percentage? ");
                //calculate final result
                GradeCalculation(percentage);

                return;
        }
```

```java
        //input
        public static String inputString(String message)
        {
                Scanner scanner = new Scanner(System.in);
                System.out.print(message);
                String answer = scanner.nextLine();

                return answer;
        }
        public static int inputInt(String message)
        {
                String num_string = inputString(message);
                return Integer.parseInt(num_string);
        }

        //grade calculation
        public static void GradeCalculation(int grade)
        {
                if(grade >= 70)
                {
                        System.out.println("Congratulations! You are on a track
↪to graduate with a 1st!");
                }
                else if(grade >= 60)
                {
                        System.out.println("Congratulations! You are on a track
↪to graduate with a 2:1!");
                }
                else if(grade >= 50)
                {
                        System.out.println("Congratulations! You are on a track
↪to graduate with a 2:2!");
                }
                else if(grade >= 45)
                {
                        System.out.println("Congratulations! You are on a track
↪to graduate with a 3rd!");
                }
                else if(grade >= 40)
                {
                        System.out.println("Congratulations! You are on a track
↪to graduate with a Pass!");
                }
                else
                {
                        System.out.println("Unfortunately, your current
↪classification is a Fail.");
```

```
                }

                return;
        }
}
```

Run your program:

```
[7]: UniversityGrading.main(null);
```

What is your average percentage?

 67

Congratulations! You are on a track to graduate with a 2:1!

1.2   Question 2 [1 mark]

Write a new version of the program from Questions 2 with added input validation. Now the program
should ask the user **repeatedly** for their average percentage until a user inputs a number between
0 and 100.

You may assume that the input is always an integer.

Example run:
What is your average percentage? -20
Invalid input. The number you provided is too low. Please give a number between 0
and 100.

What is your average percentage? 150
Invalid input. The number you provided is too high. Please give a number between
0 and 100.

What is your average percentage? 78
Congratulations! You are on a track to graduate with a 1st!

Write your answer below:

```
[4]: import java.util.Scanner;

public class UniversityGrading2
{
        public static void main(String[] args)
        {
                //ask question
                int percentage = inputPercentage("What is your average
   ↪percentage? ");
                //calculate final result
                GradeCalculation(percentage);
```

```java
                return;
        }


        //input & validation
        public static String inputString(String message)
        {
                Scanner scanner = new Scanner(System.in);
                System.out.print(message);
                String answer = scanner.nextLine();

                return answer;
        }
        public static int inputPercentage(String message)
        {
                String num_string = inputString(message);

                int perc = Integer.parseInt(num_string);
                while(!checkPercentage(perc))
                {
                        num_string = inputString(message);
                        perc = Integer.parseInt(num_string);
                }

                return perc;
        }
        public static boolean checkPercentage(int num)
        {
                if(num < 0)
                {
                        System.out.println("Invalid input. The number you␣
↪provided is too low. Please give a number between 0 and 100");
                        return false;
                }
                else if(num > 100)
                {
                        System.out.println("Invalid input. The number you␣
↪provided is too high. Please give a number between 0 and 100");
                        return false;
                }
                return true;
        }


        //grade calculation
        public static void GradeCalculation(int grade)
        {
                if(grade >= 70)
                {
```

```java
                        System.out.println("Congratulations! You are on a track
 ↪to graduate with a 1st!");
                }
                else if(grade >= 60)
                {
                        System.out.println("Congratulations! You are on a track
 ↪to graduate with a 2:1!");
                }
                else if(grade >= 50)
                {
                        System.out.println("Congratulations! You are on a track
 ↪to graduate with a 2:2!");
                }
                else if(grade >= 45)
                {
                        System.out.println("Congratulations! You are on a track
 ↪to graduate with a 3rd!");
                }
                else if(grade >= 40)
                {
                        System.out.println("Congratulations! You are on a track
 ↪to graduate with a Pass!");
                }
                else
                {
                        System.out.println("Unfortunately, your current
 ↪classification is a Fail.");
                }

                return;
        }
}
```

Run your program:

```
[5]: UniversityGrading2.main(null);
```

```
What is your average percentage?
 -20

Invalid input. The number you provided is too low. Please give a number between
0 and 100
What is your average percentage?
 150

Invalid input. The number you provided is too high. Please give a number between
0 and 100
```

```
What is your average percentage?

 78

Congratulations! You are on a track to graduate with a 1st!
```

1.3 Question 3 [1 mark]

Define a class `Student` with two instance variables, `name` and `average`. Add two methods to this class: `printWelcomeMessage` and `determineDegreeClassification`.

`printWelcomeMessage` should print a welcome message that will include the student's name. `determineDegreeClassification` should print the degree classifications based on the student's average.

Then define another class called `Main3` that contains the `main` method. The program should ask the user for their name and average. It should then use the inputted information to create an instance of a `Student` and call `printWelcomeMessage` followed by `determineDegreeClassification`.

Example run:
```
What is your name? Bob
What is your average percentage? 67

Welcome Bob to OOP!
Congratulations! You are on a track to graduate with a 2:1!
```

Write your answer below:

```java
[4]: import java.util.Scanner;

public class Main3
{
        public static void main(String[] args)
        {
                //ask questions
                String name = inputString("What is your name? ");
                int percentage = inputPercentage("What is your average␣
  ↪percentage? ");

                //create new instance of a student
                Student new_student = new Student();

                //assign the values
                new_student = SetNewStudent(new_student, name, percentage);

                //call inner methods
                PrintFinalMessage(new_student);

                return;
        }
```

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```java
        //input & validation
        public static String inputString(String message)
        {
                Scanner scanner = new Scanner(System.in);
                System.out.print(message);
                String answer = scanner.nextLine();

                return answer;
        }
        public static int inputPercentage(String message)
        {
                String num_string = inputString(message);

                int perc = Integer.parseInt(num_string);
                while(!checkPercentage(perc))
                {
                        num_string = inputString(message);
                        perc = Integer.parseInt(num_string);
                }

                return perc;
        }
        public static boolean checkPercentage(int num)
        {
                if(num < 0)
                {
                        System.out.println("Invalid input. The number you␣
↪provided is too low. Please give a number between 0 and 100");
                        return false;
                }
                else if(num > 100)
                {
                        System.out.println("Invalid input. The number you␣
↪provided is too high. Please give a number between 0 and 100");
                        return false;
                }
                return true;
        }

        //methods for Student
        public static Student SetNewStudent(Student s, String name, int avrg)
        {
                s.name = name;
                s.average = avrg;

                return s;
```

```java
            }
        public static void PrintFinalMessage(Student s)
        {
                s.printWelcomeMessage();
                s.determineDegreeClassification();

                return;
        }
}
```

[3]:
```java
public class Student
{
        String name;
        int average;

        public void printWelcomeMessage()
        {
                System.out.println("Welcome " + name + " to OOP!");

                return;
        }

        public void determineDegreeClassification()
        {
                if(average >= 70)
                {
                        System.out.println("Congratulations! You are on a track
to graduate with a 1st!");
                }
                else if(average >= 60)
                {
                        System.out.println("Congratulations! You are on a track
to graduate with a 2:1!");
                }
                else if(average >= 50)
                {
                        System.out.println("Congratulations! You are on a track
to graduate with a 2:2!");
                }
                else if(average >= 45)
                {
                        System.out.println("Congratulations! You are on a track
to graduate with a 3rd!");
                }
                else if(average >= 40)
                {
```

```
                        System.out.println("Congratulations! You are on a track␣
    ↪to graduate with a Pass!");
                }
                else
                {
                        System.out.println("Unfortunately, your current␣
    ↪classification is a Fail.");
                }

                return;
        }
}
```

Run your program:

```
[5]: Main3.main(null);
```

```
What is your name?
 Bob
What is your average percentage?
 67
Welcome Bob to OOP!
Congratulations! You are on a track to graduate with a 2:1!
```

1.4 Question 4 [1 mark]

Write a method

int countDuplicates(int[] xs)

which should return the number of duplicate entries in xs. For example if xs = {1,1,1}, the method should return 3 because xs[0], xs[1] constitutes one duplicate pair, xs[0], xs[2] the second, and xs[1],xs[2] the third. In the example xs = {0,2,1,0,2,3,0} the method should return 4 because the duplicate pairs are: 1. xs[0], xs[3], 2. xs[0], xs[6], 3. xs[3], xs[6], and 4. xs[1], xs[4].

Write your answer below:

```
[1]: public class Duplicates
    {
            public static void main(String[] args)
            {
                    int[] arr = new int[] {0,2,1,0,2,3,0};        int ans =␣
    ↪countDuplicates(arr);
                    System.out.println(ans);
```

```
                return;
        }

        public static int countDuplicates(int[] xs)
        {
                //stores number of duplicates
                int duplicates = 0;

                for(int starter = 0; starter < xs.length; starter++)
                {
                        for(int i = starter + 1; i < xs.length; i++)
                        {
                                if(xs[starter] == xs[i])
                                {
                                        duplicates++;
                                }
                        }
                }

                return duplicates;
        }
}
```

Model method:

```
[ ]: int countDuplicates(int[] xs)
     {
             //stores number of duplicates
             int duplicates = 0;

             for(int starter = 0; starter < xs.length; starter++)
             {
                     for(int i = starter + 1; i < xs.length; i++)
                     {
                             if(xs[starter] == xs[i])
                             {
                                     duplicates++;
                             }
                     }
             }

             return duplicates;
     }
```

Run your program:

```
[2]: Duplicates.main(null);
```

1.5   Question 5 [1 mark]

Write a method

`int[] filterAndReverse(int[] xs, int k)`

which does the following. If `k` is `0` it prints `wrong argument` and immediately returns. Otherwise, it takes only those entries in `xs` that are divisble by the number `k`, reverses them and puts them on a new array which is then returned.

For example when called on the array `{1,2,3,4}` with `k=2`, it should return the array `{4,2}`. This is because we take only the numbers that are divisible by `2`, which in this case is `{2,4}`, and we reverse this array to get `{4,2}`. If we call this method on the array `{1,2,3}` with `k=1`, it should return the array `{3,2,1}`, this is because every number is divisible by `1`.

Hint: First go through the array `xs` to see how many entries are divisble by `k`, this number will be the length of the array which you should return.

Write your answer below:

```
[7]: public class Thing
     {
             public static void main(String[] a)
             {
                     int[] xs = new int[] {1,2,3,4};
                     int k = 2;

                     int[] rev = filterAndReverse(xs,k);

                     for(int i = 0; i < rev.length - 1; i++)
                     {
                             System.out.print(rev[i] + ",");
                     }
                     System.out.print(rev[rev.length - 1]);

                     return;
             }

             public static int[] filterAndReverse(int[] xs, int k)
             {
             //value check
                     if(k == 0)
                     {
                             System.out.println("wrong argument");
                             return xs;
                     }
```

```
            int reverse_arr_length = 0;
            for(int i = 0; i < xs.length; i++)
            {
                    if(xs[i] % k == 0)
                    {
                            reverse_arr_length++;
                    }
            }

            int[] reverse_arr = new int[reverse_arr_length];

            int j = 0;
            for(int i = xs.length - 1; i > -1; i--)
            {
                    if(xs[i] % k == 0)
                    {
                            reverse_arr[j] = xs[i];
                            j++;
                    }
            }

            return reverse_arr;
        }

}
```

Method model:

```
[ ]: int[] filterAndReverse(int[] xs, int k)
     {
             if(k == 0)
             {
                     System.out.println("wrong argument");
                     return xs;
             }

             int reverse_arr_length = 0;
             for(int i = 0; i < xs.length; i++)
             {
                     if(xs[i] % k == 0)
                     {
                             reverse_arr_length++;
                     }
             }

             int[] reverse_arr = new int[reverse_arr_length];
```

```java
        int j = 0;
        for(int i = xs.length - 1; i > -1; i--)
        {
                if(xs[i] % k == 0)
                {
                        reverse_arr[j] = xs[i];
                        j++;
                }
        }

        return reverse_arr;
}
```

Run your program:

```java
[8]: Thing.main(null);
```

```
4,2
```