1. Problem Statement:

We can tell you what day of the week you were born. Do you even know what day you were born? Well, if you don't, don't worry because as long as you know your birthday and birth year, we can help you figure it out without using a calendar. As a group, we were tasked with the following problem: given a certain birthday (day, month, and year) after the year 1900 and before 2100, how can you find what day of the week it is (Sunday, Monday, etc.)?

Only using October 2023 as a calendar and famous people's birthdays (given), we had to make a method that could guide anyone to determine the day of the week they were born using only the four basic arithmetic operations.

2. Process:

First, we used Louis Armstrong's birthday to find out the day of the week for January 1st, 1900. We needed to use this day as a reference to determine the day of the week anyone else was born from 1900 to 2100. Since Louis Armstrong was born on August 4, 1901, a Sunday, we first calculated the number of days between January 1, 1900, and August 4, 1901. Then, we took the number of days and divided it by seven to determine the number of weeks between the two dates. In this case, since the number of weeks turned out to be an exact integer, that would mean that January 1, 1900, and August 4, 1901, both lie on the same day of the week. Since we already knew August 4, 1901, was a Sunday, January 1, 1900, would also have to be a Sunday.

After doing this, we needed to use this reference date (Sunday, January 1, 1900) to create a method of finding the day of the week for the given birthday. To create an efficient method, our basic approach was to find the total number of days between January 1, 1900, and the given birthday; then divide it by 7 to find the total number of weeks between January 1, 1900, and the

given birthday; and then use the fact that January 1, 1900, was a Sunday to determine the day of the week for the given birthday.

First, we needed to find the days between January 1, 1900, and the given birthday. We went about this by first finding the number of years between 1900 and the birth year, and then multiplying it by 365 to find the number of days. However, we also needed to account for the leap years, which we did by dividing the number of years by 4. We used this number, which was the number of leap days between the birthday and January 1, 1900, and added it to get the total number of days from January 1, 1900, to January 1 of the given birth year.

To find the total number of days between January 1, 1900, and the given birthday, we still needed to add the number of days from January 1 of the given birth year to the birthday. To find this number, we made a table (table 3) with all the months, where each month is the sum of all the days in the previous months. Then, with the number acquired from Table 3, we added it to the day in the birthday month. Now that we found the number of days from January 1 of the given birth year to the birthday, we took this sum and added it to the total number of days from January 1, 1900, to January 1 of the given birth year (previously calculated). This sum represents the total number of days between January 1, 1900, and the given birthday.

However, before moving on to the next step, we noticed that there was one step that needed to be done for a very specific case. If the given birthday is on a leap year and it is also before March 1, we needed to subtract one from the total number of days between January 1, 1900, and the given birthday. This is because when previously accounting for the leap days, since the given birth year is a leap year, we added a leap day assuming that the birthday was after the leap day (February 29). However, any birthday before the leap day (February 29) on a leap year does not need to account for the leap day because it hasn't occurred yet. That's why, for this very

specific case, you need to subtract one from the total number of days before moving on to the next step.

Lastly, we took this sum and divided it by seven. This will give the number of weeks between January 1, 1900, and the given birthday. The decimal of this number represents a certain day of the week. Since the total number of days is being divided by seven, the possible decimals would be 1/7, 2/7, 3/7, 4/7, 5/7, and 6/7. Essentially, if their quotient had no decimal, that would mean that their birthday and the reference day (Sunday, January 1, 1900) were on the same day, meaning their birthday was on a Sunday. If their quotient had the decimal 0.14285…, that decimal would represent 1/7, which means that their birthday is one day after the reference day (Sunday, January 1, 1900), meaning their birthday was on a Monday. Using this pattern, we created a table that the user can refer to, using their decimal from the quotient, to find the day of the week they were born.

3. Solution:

Table 1

Step #	**Description**	**Calculations**
Step 1	Find the difference in years between your birth year and 1900.	**Birth year – 1900** = calculation1
Step 2	Divide this number (calculation1) by 4 to get the number of leap years between your birth year and 1900. If you get a number with a decimal, truncate the decimal (chop the decimal off); only the whole number part matters.	**(int) (calculation1/4)** = calculation2
Step 3	Multiply the number of years between your birth year and 1900 (calculation1) by 365. Then, add the total number of leap years between your birth year and 1900 (calculation2) to the product to find the total number of days between January 1st, 1900, and January 1st in your birth year.	**(calculation1*365) + calcultion2** = calculation3
Step 4	Depending on which month you were born, add a certain number of days (refer to Table 2) and the day you were born. These calculations will give you a number representing the total number of days between January 1st, 1900, and your birthday. *** If you were born on a leap year (which means birth year/4 is a whole number with no decimals) AND you were born before March 1, then do the following step (if not, move on to step 5): With the calculation you have done in step 4, just subtract 1 from it. You will use this number as "calculation4" in the subsequent steps.	**calculation3 + number from table 2 + day you were born** = caculation4 **calculation4 – 1**
Step 5	Divide the total # days (calculation4) by 7.	calculation4/7 (only the first 5 digits after the decimal point are important)
Step 6	Use the decimal portion from the previous calculation to find the day of the week.	Refer to Table 3

Table 2

Month	The number needed for calculation in step 4
Jan (1)	0
Feb (2)	31
Mar (3)	59
Apr (4)	90
May (5)	120
Jun (6)	151
Jul (7)	181
Aug (8)	212
Sep (9)	243
Oct (10)	273
Nov (11)	304
Dec (12)	334

Table 3

Decimal	The day you were born on
No decimal	Sunday
0.14285…	Monday
0.28571…	Tuesday
0.42857…	Wednesday
0.57142…	Thursday
0.71428…	Friday
0.85714…	Saturday

4. Extensions:

1. Write a program that solves for what day of the week a given birthday is on (between 1900 and 2100)

```
import java.util.Scanner;
public class CalculateDay {
	public static void main(String [] args) {
		Scanner sc = new Scanner(System.in);

		System.out.print("Enter your birthday in the following format: mm/dd/yyyy ");
		System.out.print("\nYour birthday: ");
		String birthday = sc.nextLine();

		String month = birthday.substring(0,2);
		String day = birthday.substring(3,5);
		String year = birthday.substring(6);

		int m = Integer.parseInt(month);
		int d = Integer.parseInt(day);
		int y = Integer.parseInt(year);

		//calculations

		if(y>2099||y<1900)
			System.out.println("Sorry, but I can't determine the day of the week you were born. Please try a date in between 1900 and 2100");
	else {

		if(y%4==0 && m<3)
			d -= 1;

		int calc1 = y-1900;
		int calc2 = calc1/4;
		int calc3 = calc1*365 + calc2;
		int calc4 = 0;

		if (m == 1)
			calc4 = calc3;
```

```
else if (m==2)
        calc4 = calc3 + 31;
else if (m==3)
        calc4 = calc3 + 59;
else if (m==4)
        calc4 = calc3 + 90;
else if (m==5)
        calc4 = calc3 + 120;
else if (m==6)
        calc4 = calc3 + 151;
else if (m==7)
        calc4 = calc3 + 181;
else if (m==8)
        calc4 = calc3 + 212;
else if (m==9)
        calc4 = calc3 + 243;
else if (m==10)
        calc4 = calc3 + 273;
else if (m==11)
        calc4 = calc3 + 304;
else
        calc4 = calc3 + 334;

int calc5 = calc4 + d;
int calc6 = calc5%7;

String dow = " ";
if (calc6 == 0)
        dow = "Sunday";
else if (calc6 == 1)
        dow = "Monday";
else if (calc6 == 2)
        dow = "Tuesday";
else if (calc6 == 3)
        dow = "Wednesday";
else if (calc6 == 4)
        dow = "Thursday";
else if (calc6 == 5)
        dow = "Friday";
else
```

```
                dow = "Saturday";

            System.out.println("\nYou were born on: " + dow);
            System.out.println("\nThank you for playing! Please play again!");
        }
        }
}
```

2. Since a normal year is TECHNICALLY 365 days and ¼ and a little over ¼, every 100 leap years must have a “dropped” leap year. How could you make a model to determine the day of the week of any given date in any given year (after 0 AD)?