Problem of the Week #1

Problem Statement:
Given the date a person was born, find what day of the week that person was born on. This was the problem our group tackled over the past week. The only resources we had were an October calendar for 2023, a table with the number of days in each month, and a calculator that can perform basic arithmetic operations. Using these tools, we came up with a step-by-process that could provide someone with the day of the week they were born, given their date of birth.

Process:
We first found how the same date is moved ahead one day of the week every year. For example, if January 1, 2023 was a Sunday, January 1, 2024 would be a Monday. But, January 1 2025 would be a Wednesday because it went past an extra day(February 29, 2024). Similarly, if we can find how many skips would happen between the birth year and current year, then we could backtrack to find the ways. But first, we need to find the day a given birthday falls in the current year. We noticed that September 7 was 2 days of the week before October 7 because of a 30 day difference(30 mod 28=2). Similarly, October 7 was 3 days of the week before November 7. Afterwards, we used that to find the day the person's birthday falls on this year. We then backtracked it to the birth year using the pattern of how the same date skips a day in normal years and skips 2 on leap years. However, this method involved taking mod 28 of the number of days of each month until the given date this current year which wouldn't be ideal for a general solution. And it was ineffective for birthdays before February 29 on leap years or birthdays after October.

After finalizing our method, we had to reflect on how we knew it would work regardless of the given date of birth. As a whole, our process started by finding the days between the person's birthday and October 7, 2023. The reason for this was because we wanted to have a definitive date to work with (October 7th), which originated from the calendar given to us so we could then track it back to the year the person was born. The goal was to find the number of days between the birthday and October 7th and mod 7 that answer to see how many more days into the final week it took to reach October 7th. This was significant because at the start, we set an index for the days of the week, 0 being Sunday, 1 being Monday, and so on, all the way until Saturday which was index 6. Knowing this, if we mod the total number of days in between, we can identify that remainder as a day of the week and then subtract it from Saturday (index 6), to get what day of the week the person's birthday is on in 2023. But if the birth month was past October, we would add the remainder instead of subtracting from our current index because in that scenario, we would be going the opposite direction, going from October 7th to the birthday, instead of the birthday to October 7th.

From there, we had to backtrack from their birthday in the current year to their birthday in the year they were born. This concept was very straightforward as we started by subtracting the year they were born from 2023 to see how many years have passed in between. We then divided the years passed by four and rounded down to account for how many leap years took place in between and added that back to the years that had passed in total(if the birthday is before February 29 on a leap year, we add 1 to this sum account for the February 29 that was passed when we backtrack). We then subtracted this many days from our current index and mod the resulting value by 7 to get a day of the week as our final answer.

Solution:
1. The first step of the solution is to find the number of days between your birthday this year (2023) and October 7th this year by using the chart given below
    a. We set the amount of days we get as a result as x.
2. Then we find the amount of weeks that would be in x days.
    a. We do this by dividing the amount of days (x) by 7.
3. When we divide the number of days by 7 to find the amount of weeks, we also take into account the number we get as the remainder
4. Then depending on the month your birthday was in, we either subtract the remainder (that was got in step 3) from 6 if your birthday was before October 7th, or add the remainder to 6 if your birthday was after October 7th
5. We give every day of the week an index with Sundays being 0, Mondays being 1, and so on until Saturday which is a 6.
    a. Using this number, we are able to find the day that your birthday was in this year, for example if the number you got in step 4 was a 1 the day of your birthday in this year is a Monday
6. The next part of the solution is to find the difference in the years between this year (2023) and the year that you were born
7. After we find the difference we take the number from step 6, divide it by 4, and round down (ignore the decimal digits) to take the number of leap years into account
8. To find the number of days we go back from the date of your birthday this year, we add the numbers we got in step's 5 and 6
9. After finding the amount of days, we go back and take the number we solved for in step 7, divide it by seven, and find the remainder so we can take into account the amount of weeks in that time period.
10. Finally we take the remainder that we got in step 3 and subtract the remainder from step 8
    a. The number that we get will correspond to a day in the week according to the index mentioned above and that will be the answer

October 2023

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Jan 31	Feb 28	Mar 1	Apr 30	May 31	Jun 30	Jul 31	Aug 31	Sep 30	Oct	Nov 30	Dec 3
249	221	190	160	129	99	68	37	7		54	85

*don't forget extra day for leap years because you have to account for february 29th

Extension:

```python
def calculate_day_of_week(birthday_month, birthday_day, birth_year):

    if birthday_month < 3:
        birthday_month += 12
        birth_year -= 1

    K = birth_year % 100
    J = birth_year // 100

    day_of_week = (birthday_day + ((13 * (birthday_month + 1)) // 5)
+ K + (K // 4) + (J // 4) - (2 * J)) % 7

    days_of_week = ["Saturday", "Sunday", "Monday", "Tuesday",
"Wednesday", "Thursday", "Friday"]
    return days_of_week[day_of_week]

# Input the birthday month, day, and year
birthday_month = int(input("Enter the month of your birthday (1-12):
"))
birthday_day = int(input("Enter the day of your birthday (1-31): "))
birth_year = int(input("Enter the year you were born: "))

# Calculate the day of the week for the given birthday
result = calculate_day_of_week(birthday_month, birthday_day,
birth_year)
print("The day of the week for your birthday in the year you were
born is:", result)
```