Birthday POW

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Problem Statement

Did you ever wonder if your birthday fell on the same day as that of Fidel Castro? Lucky for you, our group was tasked with figuring out how to mathematically calculate which day of the week you were born on, given your birthday day, month, and year. The only resources that we could use was a calendar of the current month and a list of days that famous celebrities were born on to check if our solution was correct. .

Process

Our process to find our solution took a lot of different terms, and we went through a lot of different methods to work through it. Our first idea was very broad: we figured if we eliminated all previous weeks from the amount of weeks a person has been alive, we would be left over with a remainder which we would be able to use to find out the day of the week by just counting from what the current day was. However we soon realized that calculating the mod 7 of the number of days a person has been alive would get the same result without a person having to deal calculating the number of weeks they have been alive. We then planned out the solution to finding out the number of days a person has been alive. Originally we counted out each year how many days a person had been alive. This was very time consuming, and we sought to find out a quicker way to calculate this. We decided since every year excluding the first and last would have the same number of years, the person could find the number of normal years multiply those by 365, find the number of leap years and multiply those by 366, find the number of days alive in the first and last year, and then add them all up. In the end, we figured out since each leap year

only has one more extra day, a person can multiply the number of years total, excluding first and last, by 365 and then add 1 for every leap year. This was quicker for us than multiplying them individually, so we changed it. We had another idea of using a set date of January 1st 2024, as they would not need to calculate the number of years they had been alive this year, but we decided against this in this case or method would be used for any dates after January 1st 2024. We did this because our solution depends on the person's birthday being before the date they were calculating too, and using negative numbers in a mod might be difficult for people not used to it, so we decided on sticking with our original idea.

Solution

The first step we took was to find out how many days have passed since the person's day of birth.

Use the below variables:

X - the day of birth

Y - current date

1) Take the year after you were born (the year of X+1) and the year before the current year (the year of Y - 1) and find the total number of years that have passed. You can do this by doing (Y - 1) - (X + 1).
2) Call (Y - 1) - (X + 1) a variable named N
3) Find the number of leap years
    1) Start from the year of X and find a year that is divisible by 4
    2) Add 4 until you get to the year of X. This should give you the number of leap years.

4) Then multiply N by 365 and add the number of leap years identified in step 1 (e.g. if you found 3 leap years you would add 3).
5) Then calculate the number of days between X and 12/31/the year of X. Use the chart below and add the number below every month before the month of X
6) Then use this same method to calculate how many days into the year of Y. Add up all these numbers to get the total amount of days that have passed. Make sure to include both X and Y in these calculations.
    1) Call the total number of days passed D

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
31	28*	31	30	31	30	31	31	30	31	30	31

*29 in leap years

7) Take D and divide it by 7
8) You should either get a whole number or a rational number. If you get the whole number, use the chart below to figure out which day they were born relative to Y. If not, multiply the whole part of the number (everything before the decimal) by 7 and subtract that from D. Use the answer of that and the chart below to figure out the day

Y	Y+1	Y+2	Y+3	Y+4	Y+5	Y+6
0	1	2	3	4	5	6

Extensions

1) Develop a computer science algorithm that takes the user's day of birth as an input and returns the day the user was born as an output.

This code follows the process used in our solution but with variables in place of numbers in order to allow users to change it to specific dates. This was coded in python.

```
Xy = 2007 #X is birthday day
Xycopy = Xy
Xm = 4
Xd = 17

Yy = 2024 #Y is current day
Ym = 10
Yd = 6
leapyear = False;
Yearpassed = (Yy-1) - (Xy+1)
leapyearamount = -1

while (leapyear == False):
    if (Xycopy % 4 == 0):
        leapyear = True
    else:
        leapyear = False
        Xycopy += 1

while (Xycopy <= Yy):
    Xycopy += 4
    leapyearamount +=1
leapyear = False
if(Xycopy==Yy):
    leapyearamount=-1
    leapyear = True


dayspassed = (Yearpassed * 365) + (leapyearamount)

if (Ym >= 1):
    dayspassed += 31

if (Ym >= 2 and leapyear == True):
    dayspassed += 29
```

```
if (Ym >= 2 and leapyear == False):
    dayspassed += 28

if (Ym >= 3):
    dayspassed += 31

if (Ym >= 4):
    dayspassed += 30

if (Ym >= 5):
    dayspassed += 31

if (Ym >= 6):
    dayspassed += 30

if (Ym >= 7):
    dayspassed += 31

if (Ym >= 8):
    dayspassed += 31

if (Ym >= 9):
    dayspassed += 30

if (Ym >= 10):
    dayspassed += 31

if (Ym >= 11):
    dayspassed += 30

if (Ym >= 12):
    dayspassed += 31

dayspassed += 366

if (Xm >= 1):
    dayspassed -= 31

if (Xm >= 2 and leapyear == True):
    dayspassed -= 29

if (Xm >= 2 and leapyear == False):
    dayspassed -= 28
```

```
if (Xm >= 3):
    dayspassed -= 31

if (Xm >= 4):
    dayspassed -= 30

if (Xm >= 5):
    dayspassed -= 31

if (Xm >= 6):
    dayspassed -= 30

if (Xm >= 7):
    dayspassed -= 31

if (Xm >= 8):
    dayspassed -= 31

if (Xm >= 9):
    dayspassed -= 30

if (Xm >= 10):
    dayspassed -= 31

if (Xm >= 11):
    dayspassed -= 30

if (Xm >= 12):
    dayspassed -= 31

dayspassed = dayspassed % 7

if (dayspassed == 0):
    print("wed")

if (dayspassed == 1):
    print("thu")

if (dayspassed == 2):
    print("fri")

if (dayspassed == 3):
    print("sat")
```

```
if (dayspassed == 4):
    print("sun")

if (dayspassed == 5):
    print("mon")

if (dayspassed == 6):
    print("tue")

print(dayspassed)
```

2) Make a video detailing the process used so that it is more clear to the viewer: https://youtu.be/Sd24dDxdwsk
3) Figure out how we can calculate what day someone was born past a century

The reason our current method doesn't work is due to centuries not following the leap year rule. Currently we have it that every four years a person needs to add one extra day to the year. This is due to the assumption that every year is actually 365.25 days. However, the actual number of days per year is a little less than 365.25 days. To compensate for this, mathematicians have determined that only one out of every four centuries will have a leap year at the beginning of them (e.g. 2000 was a leap year, but 2100 will not, 2200 will not, and 2300 will not). In order to take this into account in our solution one extra step needs to be added. A person will need to check if any of their years ends in 00 (or divisible by 100). They can calculate the number of these years by taking the number of years they have been alive, dividing by 100, and then rounding down (the result is the number of years divisible by 100). The person will then need to find these years and see if they are divisible by 400. If they are, they will include this year when counting the number of leap years, but if not it will be considered as not a leap year. The rest of the solution will continue on as normal.