

# CS290P Homework1

November 23, 2021

## 1 Gregorian calendar

You should implement a class named Gregorian first.

Leap years of the Gregorian calendar

- years divisible by 4000 are 'NOT' leap years
- years divisible by 400 but not by 4000 'ARE' years
- years divisible by 100 but not by 400 are 'NOT' leapyears
- years divisible by 4 but not by 100 'ARE' leap years
- years not divisible by 4 are 'NOT' leap years.

### Input

The class contains the public functions:

```
void Gregorian:: Gregorian(int year, char* month, int day)  \\  
void Gregorian:: $print_today()$  
print the date of today in Gregorian format by "year_month_day"  
void Gregorian:: print_month ()  
print the calendar of the current month in Gregorian format.  
void Gregorian:: print_year ()  
print the calendar of the current year in Gregorian format  
bool Gregorian:: go_to(int year, char* month, int day)  
go to the given day. Return true if the day in the range Jan 1,1 to  
Dec 31,999999. Else false.  
bool Gregorian:: pass_day(int num_days)  
pass the given number of days from today.  
Return true if that day is in the range.  
Else roll back to the origin day and return false.  
bool Gregorian:: pass_month(int num_months)  
pass the given number of months from today.  
Return true and slide to the first day of that month if that month is in  
the former range.  
Else roll back to the origin day and return false.  
bool Gregorian:: pass_year(int num_years)  
pass the given number of years from today.  
Return true and slide to the first day of that year if that year is in  
the former range.  
Else roll back to the origin day and return false.
```

Note that the day or month or year to pass might be a negative int.

## 2 ShanghaiTech Calendar

### Overview

The ShanghaiTech calendar is a year, month and date frame.

### Date

The coding system of dates is a hexadecimal system. The characters are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F. The first day is Day 1, and the second day is Day 2, and so on.

### Week

Same as those in the Gregorian calendar, days in the ShanghaiTech calendar are grouped into 7-day weeks.

- Sun
- Mon
- Tues
- Wed
- Thur
- Fri
- Sat

### Year

A month usually contains 39, 40 or 41 days. The exact number of days of a certain month is  $D = 39 + ((10Y - M) \bmod 3)$ , where

- D is the number of days
- Y is the year
- M is the month

There are 9 months a year:

- Sist
- Spst
- Slst
- Sem
- Sca
- Ims

and when calculating, we let (Sist = 1, Spst = 2, ..., Ih = 9) A year is a leap year if it satisfies  $[Y + S(Y)] \bmod 8 = 0$  where

- Y is the year
- $S(x)$  means the **digit sum** of x in binary.

A leap year has 10 months, the extra one called the leap month, which satisfies  $M = [Y - S(Y)] \bmod 9 + 1$  where

- M is the leap month
- Y is the year
- $S(x)$  means the **digit sum** of x in binary.

It means the leap month immediately follows Month M and it is the same as Month M only with its name capitalized.

For example, Year 1029 is 10,000,000,101 in binary,  $(1029 + 3*1) \bmod 8 = 0$ , so it is a leap year;  $(1029 - 3*1) \bmod 9 + 1 = 1$  so Year 1029 has 10 month: Sist, SIST, Spst, Slst, Sem, Sca, Ims, Ihuman, Siais and Ih.

## Requirements

You should implement a class named Shanghaitech which inherits the class Gregorian. And the methods of Gregorian should also work properly for the instance of Shanghaitech to update its Gregorian date (Polymorphism). Besides, you should reload all the required methods in the former part to support the Shanghaitech calendar format.

To update the Gregorian date for an instance of Shanghaitech calendar, we use a pointer of Gregorian to access the methods in class Gregorian. However, after that, you also need to update date of Shanghaitech calendar. You should reserve a virtual function in the Gregorian class as a callback function. Each time we update the Gregorian date for an instance of Gregorian's child class, the virtual function should be called to update the date of its child calendar (do nothing if not a child calendar). In this case, you should implement the virtual function in the Shanghaitech class.

## Notes

- Jan 1 of the Gregorian calendar Year 1 is Sist 1 of the ShanghaiTech calendar Year 1.
- Use the boundary date of the former Gregorian class, and transform the boundary date into Shanghaitech date.
- No STL library except string
- library is allowed in your code. Apart from the auto-graded grades, we will also manually check whether your code satisfies the requirements.

Added: **We have provided a main function for you here. You just need to implement these two classes below, and oj will append the main function for you.**

## Time Limit

2s

## Input

- The first line of the input creates a Shanghaitech object.
- You should only create one object in your main function.
- Following lines begin with S or G.

- S means call the method of Shanghaitech for the object created in the first line with the following parameters in that line.
- G means call the method of Gregorian whose name is same as the method in the Shanghaitech class for the same object in the first line (By using a pointer of parent object).

## Output

- All the result of your methods.
- There should be no empty lines in the output between two functions calls.