p3.24

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1 Specification

A year with 366 days is called a leap year. A year is a leap year if it is divisible by four (for example, 1980), except that it is not a leap year if it is divisible by 100 (for example, 1900); however, it is a leap year if it is divisible by 400 (for example, 2000). There were no exceptions before the introduction of the Gregorian calendar on October 15, 1582 (1500 was a leap year). Write a program that asks the user for a year and computes whether that year is a leap year.

2 Analysis/Design

A non-leap year has 365 days. The extra day for leap year occurs in February. i.e. Feb 28 is last day for non-leap year. But Feb 29th for leap year. This algorithm implements this idea:

```
if year modulo 4 is 0
   then
        if year modulo 100 is 0
            then
                if year modulo 400 is 0
                    then
                        is_leap_year
                else
                    not_leap_year
        else is_leap_year
else not_leap_year
```

however, this only works if $year \geq 1582$

- Get year
- Determine if it is a leap year
- Display result

3 Implementation

"p3_24.cpp" 2a≡

```
⟨ Include files ? ⟩

int main()
{
        ⟨ get values 2b ⟩
        ⟨ leap year status 3a ⟩
        ⟨ display result 3b ⟩
}
◇
```

Get year value from user

⟨ *get values* 2b ⟩ ≡

```
        int year;

        cout << "Please enter a year: ";
        cin >> year;
◇
```

Fragment referenced in 2a.

Use if statements to determine if user submitted year is a leap year

⟨ *leap year status* 3a ⟩ ≡

```
bool leap_year;
leap_year = 0;

if (year >= 1582)
{
        if(year % 4 == 0)               // year divisible by 4 = leap year
                leap_year = true;
        else                            // year !divisible by 4 != leap year
                leap_year = false;


        if (year % 100 == 0)
        {
                if (year % 400 == 0)
                        leap_year = true;
                else
                        leap_year = false;
        }
}
else
{
        if(year % 4 == 0)               // year divisible by 4 = leap year
                leap_year = true;
        else                            // year !divisible by 4 != leap year
                leap_year = false;
}
◇
```

Fragment referenced in 2a.

Output status of processed year to screen

⟨ *display result* 3b ⟩ ≡

```
        if(leap_year)
        {
                cout << year << " is a leap year";
        }
        else
        {
                cout << year << " is not a leap year";
        }
◇
```

Fragment referenced in 2a.

These are the include files needed for library function calls

⟨ *Include files ?* ⟩ ≡

```
#include <iostream>
using namespace std;
```

◇

Fragment referenced in 2a.

4 Test

year	leap?
2011	f
1500	t
1584	t
1700	f
1600	t