

```

using namespace std;
#include <string>
#include <iostream>
class Airport
{
public:
    string airCode;
    void setAirCode(string a);
    string getAirCode();

    double latitude;
    void setLatitude(double lat);
    double getLatitude();

    double longitude;
    void setLongitude(double lon);
    double getLongitude();

    char timeZone;
    void setTimeZone(char a);
    char getTimeZone();

    Airport();
    Airport(string a, double b ,double c, char d);

    string toString();
};

Airport::Airport()
{
    airCode = "";
    latitude = 0;
    longitude = 0;
    timeZone = 'z';
}

Airport::Airport(string a, double b, double c, char d)
{
    airCode = a;
    latitude = b;
    longitude = c;
    timeZone = d;
}

void Airport::setAirCode(string a)
{
    airCode = a;
}

void Airport::setLatitude(double lat)
{
    latitude = lat;
}

void Airport::setLongitude(double lon)
{
    longitude = lon;
}

void Airport::setTimeZone(char a)
{
    timeZone = a;
}

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}
string Airport::getAirCode()
{
    return airCode;
}
double Airport::getLatitude()
{
    return latitude;
}
double Airport::getLongitude()
{
    return longitude;
}
char Airport::getTimeZone()
{
    return timeZone;
}
string Airport::toString()
{
    string output = "";
    output += airCode + " " + to_string(latitude) + " " + to_string(longitude) + " " +
timeZone;
    return output;
}

```

```

// These functions include various date manipulation algorithms

//-----
// This function receives an integer year and returns true if the
// year is a leap year and false otherwise.
bool leapYear(int theYear);

//-----
// This function receives an integer month and year and returns an
// integer of the number of days in the month. Leap years are
// considered.
int DaysInMonth(int theMonth, int theYear);

//-----
// This function receives a valid calendar date and returns the Julian
// date (the day number of the date in that year).
int julianDate(int theMonth, int theDay, int theYear);

//-----
// This method receives a calendar date and returns a boolean value
// defining the validity of the date.
bool validDate(int mon, int day, int yr);

//-----
// This function receives a valid date and returns a date code for the
// day of the week. It counts the number of days since 1/1/1900
// which was on a Sunday. Output is: 0=Sun,1=Mon, ..., 6=Sat.
int weekDay(int mon, int day, int year);

//-----
// This function receives a day code and returns the string (2nd
// parameter with the three-character day of the week descriptor
// (0=Sun,1=Mon, ..., 6=Sat)
void dayCode(int code, char descript[]);

```

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// Sunrise/Sunset module
//
// Author: T. Klingler
//-----

// Misc constants (as needed)
//const double pi = 3.1415962536;

//-----
// Time zone data type:
//   E Eastern time zone
//   C Central time zone
//   M Mountain time zone
//   P Pacific time zone
//   U Universal (Greenwich Mean) time

//-----

// Texttime data type (time returned as string)
typedef char TextTime[8];

//-----//
// This function receives a date and geographical coordinates //
// returns the sunrise and sunset for that day and location //
// Input: //
//   latitude: Latitude of site (pos. float in degrees) //
//   longitude: Longitude of site (pos. float in degrees) //
//   mon: Month (integer 1..12) //
//   day: Day of month (1..31) //
//   year: Year (4-digit integer 19xx or 20xx) //
//   timeZone: Code for time zone //
//   DST bool indicating if daylight savings time //
//           is active. //
// Output: //
//   sun_rise Sunrise value (string) //
//   sun_set Sunset value (string) //
// Preconditions: //
//   * Date is valid; year is four-digit //
//   * Latitude and longitude is 0.0 .. 90.0 degrees //
//   * Time zone codes must be 'E', 'C', 'M', or 'P' only) //
// Postconditions: //
//   * Date and geog. coords. unchanged //
// //
// Algorithm extracted from a BASIC program in Weatherwise //
// Magazine. It was converted to Pascal in 1995 and then to //
// this C++ version. //

void Sun_Rise_Set( double latitude, double longitude,
                  int mon, int day, int year,
                  char timeZone, bool DST,
                  TextTime sun_rise, TextTime sun_set);

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// This file includes implementations for date functions
#define _CRT_SECURE_NO_WARNINGS
#include <iostream>
#include <string>
using namespace std;

#include "datefun.h"

//-----
// This function receives an integer year and returns true if the
// year is a leap year and false otherwise.

bool leapYear(int theYear)
{
    if ( theYear % 400 == 0 ||
        ( theYear % 4 == 0 && theYear % 100 != 0 ) )
        return true;
    else
        return false;
} // end function leapYear

//-----
// This function receives an integer month and year and returns an
// integer of the number of days in the month. Leap years are
// considered.

int DaysInMonth(int theMonth, int theYear)
{
    int days = 0;

    // 31 Day theMonths
    if (theMonth == 1 || theMonth == 3 || theMonth == 5 ||
        theMonth == 7 || theMonth == 8 || theMonth == 10 ||
        theMonth == 12 )
        days = 31;

    // 30 Day theMonths
    else if (theMonth == 4 || theMonth == 6 ||
        theMonth == 9 || theMonth == 11 )
        days = 30;

    // February
    else // theMonth == 2
        if ( leapYear(theYear) )
            days = 29;
        else
            days = 28;

    return days;
} // end function DaysInMonth

//-----
// This function receives a valid calendar date and returns the Julian
// date (the day number of the date in that year).

int julianDate(int theMonth, int theDay, int theYear)

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{
    int dayCnt = 0;
    int mon;
    for (mon = 1; mon < theMonth; mon++)
        dayCnt += DaysInMonth(mon,theYear);
    dayCnt += theDay;

    return dayCnt;
} // end function julianDate

//-----
// This function validates a calendar date and returns 'true' if
// all three components represent a valid date and 'false' otherwise

bool validDate(int mon, int day, int yr)
{
    bool valDate = true;    // Assume a good date

    // Test for conditions that would make the date validity false
    if (yr < 1900)
        valDate = false;
    if ((mon < 1) || (mon > 12) || (day < 1) || (day > 31))
        valDate = false;
    else if (((mon == 4) || (mon == 6) || (mon == 9) || (mon == 11)) && (day == 31))
        valDate = false;
    else if ((mon == 2) && leapYear(yr) && (day > 29))
        valDate = false;
    else if ((mon == 2) && ! leapYear(yr) && (day > 28))
        valDate = false;

    return valDate;
} // end function validDate

//-----
// This function receives a valid date and returns a date code for the
// day of the week. It counts the number of days since 1/1/1900
// which was on a Sunday. Output is: 0=Sun,1=Mon, ..., 6=Sat.

int weekDay(int mon, int day, int year)
{
    int DayCnt;
    int daynum,i;

    DayCnt = (year - 1900) * 365;
    DayCnt += ((year - 1900) / 4) + 1;
    for (i=1;i<=mon-1;i++)
        switch(i)
        {
            case 2:    DayCnt +=28; break;
            case 4:
            case 6:
            case 9:
            case 11:    DayCnt +=30; break;
            default:    DayCnt +=31;
        };

    if (((year - 1900) % 4 == 0) && (mon <= 2))

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        DayCnt--;
    DayCnt += day;
    daynum = (DayCnt - 1) % 7;

    return daynum;
} // end function weekDay

//-----
// This function receives a day code and returns the string (2nd
// parametere with the three-character day of the week descriptor
// (0=Sun,1=Mon, ..., 6=Sat)
void dayCode(int code, char descript[])
{
    switch(code)
    {
        case 0: strcpy(descript, "SUN"); break;
        case 1: strcpy(descript, "MON"); break;
        case 2: strcpy(descript, "TUE"); break;
        case 3: strcpy(descript, "WED"); break;
        case 4: strcpy(descript, "THU"); break;
        case 5: strcpy(descript, "FRI"); break;
        case 6: strcpy(descript, "SAT"); break;
    }; // end switch
}

```

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#include <iostream>
#include <iomanip>
#include <fstream>
#include <string>
#include "airports.h"
#include "datefun.h"
#include "sun.h"
/*
Created by Nathan Gaffney
CST 280 ADV C++
Program1
THis program displays the sunrise and
sunset of the week of a given date.
*/

using namespace std;
const int MAXARRAY = 100;
/*Function Prototypes*/
void buildLstAirports(Airport a[], int& numNumbers);
void validateData(int year, int month, int day, string airCode, Airport lstAirports[],
int numElems);
bool isDST(char day[], int month, int weekdayValue, int dayNumber );
int main()
{
    /******/
    //For the Continue Loop
    char answer;
    bool cont = true;
    /******/
    int numElems = 0;
    int enteredDate, yearInt, monthInt, dayInt;
    string airCode;
    bool DST= false;
    int dayNum;
    char day[3];
    double latitude, longitude;
    char timeZone;
    TextTime sunRise, sunSet;
    Airport lstAirports[MAXARRAY];
    buildLstAirports(lstAirports, numElems);

    do
    {
        cout << "Enter a date in the format of yyyyymmdd: ";
        cin >> enteredDate;
        yearInt = enteredDate / 10000;
        monthInt = enteredDate%10000/100;
        dayInt = enteredDate % 100;

        cout << "Enter an airport three character code: ";
        cin >> airCode;
        for (int i = 0; i < 3; i++)
        {
            airCode[i] = toupper(airCode[i]);
        }
        validateData(yearInt, monthInt, dayInt, airCode, lstAirports, numElems);
        dayNum = weekDay(monthInt, dayInt, yearInt);
        DST = isDST(day, monthInt, dayNum, dayInt);
    }
}

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for (int i = 0; i < numElems ; i++)
{
    if (airCode == lstAirports[i].getAirCode())
    {
        latitude = lstAirports[i].getLatitude();
        longitude = lstAirports[i].getLongitude();
        timeZone = lstAirports[i].getTimeZone();
    }
}

/*****Output*****/
for (int i = dayNum; i > 0; i--)
{
    if (dayInt - 1 == 0)
    {
        if (monthInt - 1 == 0)
        {
            yearInt--;
            monthInt = 12;
            dayInt = DaysInMonth(monthInt, yearInt) - 1;
        }
        else
        {
            monthInt--;
            dayInt = DaysInMonth(monthInt, yearInt) - 1;
        }
    }
    else
    {
        dayInt--;
    }
}
for (int i = 0; i <= 6; i++)
{
    if (dayInt > DaysInMonth(monthInt, yearInt))
    {
        if (monthInt >= 12)
        {
            yearInt++;
            monthInt = 1;
        }
        else
        {
            monthInt++;
        }
        dayInt = 1;
    }
    dayCode(weekDay(monthInt, dayInt, yearInt), day);
    cout << day << " ";
    cout << setw(2) << setfill('0') << dayInt; //Creates a 0 infront of
single digits
    switch (monthInt)
    {
        case 1:
            cout << " JAN ";

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        break;
    case 2:
        cout << " FEB ";
        break;
    case 3:
        cout << " MAR ";
        break;
    case 4:
        cout << " APR ";
        break;
    case 5:
        cout << " MAY ";
        break;
    case 6:
        cout << " JUN ";
        break;
    case 7:
        cout << " JUL ";
        break;
    case 8:
        cout << " AUG ";
        break;
    case 9:
        cout << " SEP ";
        break;
    case 10:
        cout << " OCT ";
        break;
    case 11:
        cout << " NOV ";
        break;
    case 12:
        cout << " DEC ";
        break;
    default:
        break;
}
Sun_Rise_Set(latitude, longitude, monthInt, dayInt, yearInt,
timeZone, DST, sunRise, sunSet);
cout << yearInt << " ";
cout << "Rise: " << sunRise << " am" << " ";
cout << "Set: " << sunSet << " pm" << endl;
dayInt++;
}
/*****Continuation Loop*****/
cout << "Do you want to continue? Y/N: ";
cin >> answer;
if (answer != 'Y' && answer != 'y')
{
    if (answer == 'N' || answer == 'n'){ cont = false; }

    else
    {
        cout << "Incorrect character entered. Exiting." << endl;
        cont = false;
    }
}
}

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    } while (cont);
    system("pause");
    return 0;
}

void buildLstAirports(Airport a[], int& numNumbers)
{
    int i = 0;
    string string;
    char char1;
    double number1, number2;

    ifstream fileIn;
    fileIn.open("cityinfo.txt");

    if (fileIn.fail())
    {
        cout << "Problem opening file";
        exit(-1);
    }

    fileIn >> string >> number1 >> number2 >> char1;
    a[i].setAirCode(string);
    a[i].setLatitude(number1);
    a[i].setLongitude(number2);
    a[i].setTimeZone(char1);

    while (!fileIn.eof() && i < MAXARRAY)    // Test for end of file and array
    {
        i++;
        fileIn >> string >> number1 >> number2 >> char1;
        a[i].setAirCode(string);
        a[i].setLatitude(number1);
        a[i].setLongitude(number2);
        a[i].setTimeZone(char1);
    }
    numNumbers = i;
}

void validateData(int year, int month, int day, string airCode, Airport list[], int
numElems)
{
    bool found = false;
    if (!validDate(month, day, year))
    {
        cout << "Invalid date! Exiting.";
        system("pause");
        exit(1);
    }
    for (int i = 0; i < numElems && !found; i++)
    {
        if (airCode == list[i].getAirCode()){ found = true; }
    }
    if (!found)
    {
        cout << "Invalid Airport Code! Exiting.";
        system("pause");
        exit(1);
    }
}

```

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    }
}
bool isDST(char day[], int month, int weekdayValue, int dayNumber)
{
    bool isDST = false;

    if (month == 4 || month == 5 || month == 6 || month == 7 || month == 8)
    {
        isDST = true;
    }
    else
    {
        if (month == 3)
        {
            switch (weekdayValue)
            {
                case 0:    if (dayNumber >= 8)
                           isDST = true;

                           break;
                case 1:    if (dayNumber >= 14)
                           isDST = true;

                           break;
                case 2:    if (dayNumber >= 13)
                           isDST = true;

                           break;
                case 3:    if (dayNumber >= 12)
                           isDST = true;

                           break;
                case 4:    if (dayNumber >= 11)
                           isDST = true;

                           break;
                case 5:    if (dayNumber >= 10)
                           isDST = true;

                           break;
                case 6:    if (dayNumber >= 9)
                           isDST = true;

                           break;
            };
        }
        else
        {
            switch (weekdayValue)
            {
                case 0:    if (dayNumber <= 1)
                           isDST = false;
                           break;
                case 1:    if (dayNumber <= 7)
                           isDST = true;

                           break;
            }
        }
    }
}

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```
        case 2:    if (dayNumber <= 6)
                    isDST = true;

                    break;
        case 3:    if (dayNumber <= 5)
                    isDST = true;

                    break;
        case 4:    if (dayNumber <= 4)
                    isDST = true;

                    break;
        case 5:    if (dayNumber <= 3)
                    isDST = true;

                    break;
        case 6:    if (dayNumber <= 2)
                    isDST = true;

                    break;
    };
}

}
return isDST;
}
```

```

#include <iostream>
#include <string>
#include <cmath>
using namespace std;

#include "sun.h"
#ifdef _MSC_VER
#define _CRT_SECURE_NO_WARNINGS
#endif
// Function prototype
void sunriset (double, double, int, int, int, int&, int&);
void adjusttime (int, char, bool, TextTime);
char DigitChar(int);

void sunriset (double lat, double lon, int mo, int da, int yr,
               int& RI, int& SE)
{
    double FC,TN,X,Y,T,T9,S,A,Z,YD,WD,pi;
    double MA,A0,A1,ML,L0,L1,C,N,E,E0,W;
    double DL,TL,OB,DE,RA,S0,H,ZT;
    // double Q,TA,RV,JD;
    int sw,sw1;
    void f1(void);
    pi = 3.141592654;
    FC = 2 * pi;OB=0.409095;
    L0=4.88376619;L1=0.017202791;
    A0=6.23471229;A1=0.01720197;
    E =0.016728;
    E0=0.00218;

    TN = (lon/FC) + 0.5;
    X = 1; Y = 1;
    sw = 0;goto f1;
f1_1:
    T9 = T;
    X = da; Y = mo;
    sw = 1;goto f1;
f1_2:
    YD=T-T9+1;
    X=floor(T+1)/7;Y=floor(X);
    WD=floor(7*(X-Y)+0.5);
    T=T+3449.5+TN;
    X=YD-WD;
    goto f2;
f2_1:// Q=ML-RA;
    X=-0.0143;
    goto f4;
f4_1:
    if (fabs(Y)>=1)
    {
        RI = -9999;
        SE = -9999;
    }
    S0=Z;H=-S0;
    sw1=0;goto f5;
f5_1:
    X=ZT+E0;
    sw1=0;goto f6;

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f6_1:
RI=int(X*100+Y);
H=S0;
sw1=1;goto f5;
f5_2:
X=ZT+E0;
sw1=1;goto f6;
f6_2:SE=int(X*100+Y);
goto f_end;

// Subroutine f1 (810)
f1:T = 367*(yr-1980);
T=T-floor(7*(yr+floor((Y+9)/12))/4);
if ((Y-9) > 0) S= 1;if((Y-9) < 0) S=-1; if ((Y-9) == 0) S= 0;
A=fabs(Y-9);
Z=floor((yr+S*floor(A/7))/100);
T=T-floor(3*(Z+1)/4);
T=T+floor(275*Y/9)+X - 0.5;
// JD=T+2447689;
if (sw == 0) goto f1_1;
if (sw == 1) goto f1_2;

// Subroutine f2 (900)
f2:MA=A0+A1*T;
ML=L0+L1*T;
X=sin(ML);Y=cos(ML);
sw = 0;goto f3;
f3_1:
ML=Z;
DL=2*E*sin(MA)+1.25*(E*E)*sin(2*MA);
// TA=MA+DL;
TL=ML+DL;
// RV=(1-(E*E))/(1+E*cos(TA));
X=sin(TL)*sin(OB);Y=sqrt(1-(X*X));
sw=1;
goto f3;
f3_2:
DE=Z;if (Z>pi) Z=-FC;
X=sin(TL)*cos(OB);Y=cos(TL);
sw=2;
goto f3;
f3_3:
RA=Z;
goto f2_1;

// Subroutine f3 (570)
f3:C=0;N=0;
if (Y != 0.0)
    Z=X/Y;
else
{
    Z=0;C=1;
    if (X<0) N=1;
}
Z=atan(Z);
if (C==1) Z=pi/2-Z;
if (N==1) Z=-1*Z;
if (Y<0) Z=Z+pi;

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        adjust = 500;
    else
        adjust = 600;
    break;
case 'M': if (DST)
        adjust = 600;
    else
        adjust = 700;
    break;
case 'P': if (DST)
        adjust = 700;
    else
        adjust = 800;
};

time = time - adjust;
if (time < 0)
    time += 2400;
if (tzone == 'U')
    strcpy(suffix, "Z");
else
{
    if (time > 1200)
        strcpy(suffix, "pm");
    else
        strcpy(suffix, "am");
    time %= 1200;
    if (time < 100)
        time += 1200;
}
strcpy(tempTime, "");
strcpy(addchar, " ");
if (time > 1000)
{
    addchar[0] = DigitChar(time / 1000);
    strcpy(tempTime, addchar);
}
else if (tzone == 'U')
    strcpy(tempTime, "0");
addchar[0] = DigitChar((time % 1000) / 100);
strcat(tempTime, addchar);
addchar[0] = DigitChar((time % 100) / 10);
strcat(tempTime, addchar);
addchar[0] = DigitChar(time % 10);
strcat(tempTime, addchar);
strcat(tempTime, suffix);

if (tzone != 'U')
{
    if (time > 1000)
        i = 2;
    else
        i = 1;
    j = strlen(tempTime);
    while (j >= i)
    {
        tempTime[j+1] = tempTime[j];
        j--;
    }
}

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    }
    tempTime[i] = ':';
}
strcpy(timeout,tempTime);
}

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void Sun_Rise_Set( double latitude, double longitude,
                  int mon, int day, int year,
                  char timeZone, bool DST,
                  TextTime sun_rise, TextTime sun_set)
{
    int rise,set;

    // Convert to radians
    latitude = latitude * 3.14 / 180;
    longitude = longitude * 3.14 / 180;
    sunriseset(latitude,longitude,mon,day,year,rise,set);

    adjusttime(rise, timeZone, DST, sun_rise);
    adjusttime(set,  timeZone, DST, sun_set );
}

```

Enter a date in the format of yyyyymmdd: 20150629

Enter an airport three character code: mbs

SUN 28 JUN 2015 Rise: 5:58am am Set: 9:21pm pm

MON 29 JUN 2015 Rise: 5:58am am Set: 9:21pm pm

TUE 30 JUN 2015 Rise: 5:59am am Set: 9:21pm pm

WED 01 JUL 2015 Rise: 5:59am am Set: 9:21pm pm

THU 02 JUL 2015 Rise: 6:00am am Set: 9:21pm pm

FRI 03 JUL 2015 Rise: 6:00am am Set: 9:21pm pm

SAT 04 JUL 2015 Rise: 6:01am am Set: 9:20pm pm

Do you want to continue? Y/N: y

Enter a date in the format of yyyyymmdd: 20151228

Enter an airport three character code: LAX

SUN 27 DEC 2015 Rise: 6:57am am Set: 4:52pm pm

MON 28 DEC 2015 Rise: 6:58am am Set: 4:52pm pm

TUE 29 DEC 2015 Rise: 6:58am am Set: 4:53pm pm

WED 30 DEC 2015 Rise: 6:58am am Set: 4:54pm pm

THU 31 DEC 2015 Rise: 6:58am am Set: 4:54pm pm

FRI 01 JAN 2016 Rise: 6:59am am Set: 4:55pm pm

SAT 02 JAN 2016 Rise: 6:59am am Set: 4:56pm pm

Do you want to continue? Y/N: Y

Enter a date in the format of yyyyymmdd: 20151106

Enter an airport three character code: DeN

SUN 01 NOV 2015 Rise: 6:28am am Set: 4:58pm pm

MON 02 NOV 2015 Rise: 6:29am am Set: 4:57pm pm

TUE 03 NOV 2015 Rise: 6:30am am Set: 4:55pm pm

WED 04 NOV 2015 Rise: 6:31am am Set: 4:54pm pm

THU 05 NOV 2015 Rise: 6:33am am Set: 4:53pm pm

FRI 06 NOV 2015 Rise: 6:34am am Set: 4:52pm pm

SAT 07 NOV 2015 Rise: 6:35am am Set: 4:51pm pm

Do you want to continue? Y/N: y

Enter a date in the format of yyyyymmdd: 20150704

Enter an airport three character code: LAF

SAT 27 JUN 2015 Rise: 6:19am am Set: 9:22pm pm

SUN 28 JUN 2015 Rise: 6:20am am Set: 9:22pm pm

MON 29 JUN 2015 Rise: 6:20am am Set: 9:22pm pm

TUE 30 JUN 2015 Rise: 6:21am am Set: 9:22pm pm

WED 01 JUL 2015 Rise: 6:21am am Set: 9:22pm pm

THU 02 JUL 2015 Rise: 6:22am am Set: 9:21pm pm

FRI 03 JUL 2015 Rise: 6:22am am Set: 9:21pm pm

Do you want to continue? Y/N:

Enter a date in the format of yyyyymmdd: 20151111

Enter an airport three character code: FWA

Invalid Airport Code! Exiting.Press any key to continue . . .

Enter a date in the format of yyyyymmdd: 20130931

Enter an airport three character code: dfw

Invalid date! Exiting.Press any key to continue . . .