

# Assignment 6 (15/15)

## 1. Matrix multiplication

**1.1 [5 points]** Write a program Main.f90 to read fortran\_demo1/M.dat as the matrix M, and fortran\_demo1/N.dat as the matrix N.

**1.2 [5 points]** Write a subroutine Matrix\_mult.f90 to do matrix multiplication.

**1.3 [5 points]** Call the subroutine Matrix\_mult() from Main.f90 to compute  $M \times N$ ; write the output to a new file MN.dat, values are in format of f9.2.

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首先写出两个程序 createM.f90 和 createN.f90 来生成两个随机数字的矩阵

然后运行两个程序 createM.f90 和 createN.f90 随机的把生成的两个矩阵存在 M.dat 和 N.dat

矩阵乘法通过循环矩阵里的元素相乘再加和。经查 Fortran 提供一个直接的函数 matmul(A,B) 来计算矩阵 AB。详情请在 Matrix\_mult.f90 和 Main.f90 中查看细节

The calculation of matrix is correct.

For only in one column in your MN.dat, you can use write(66,'(5f9.2)') outmax(i,:), replacing write(66,'(f9.2)') outmax(i,:), when you write MN.dat. Then, you can get  $5 \times 5$  matrix

## 2. Calculate the Solar Elevation Angle

Good (25/25).

**2.1 [5 points]** Write a module Declination\_angle that calculates the *declination angle* on a given date

You can use asind and sin to calculate angle in degree...

**2.2 [10 points]** Write a module Solar\_hour\_angle that calculates the *solar hour angle* in a given location for a given date and time

**2.3 [5 points]** Write a main program (Solar\_elevation\_angle.f90) that uses module Declination\_angle and Solar\_hour\_angle to calculate and print the SEA in a given location for a given date and time


**2.4 [5 points]** Create a library (libsea.a) that contains Declination\_angle.o and Solar\_hour\_angle.o. Compile Solar\_elevation\_angle.f90 using libsea.a. Print the SEA for Shenzhen (22.542883N, 114.062996E) at 10:32 (Beijing time; UTC+8) on 2021-12-31

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[ese-zhangchjy@login03 fortran_demo1]$ gfortran Solar_elevation_angle.f90 -o Q2.x -L. -lsolar
/usr/bin/ld: 找不到 -lsolar
collect2: 错误: ld 返回 1
[ese-zhangchjy@login03 fortran_demo1]$ ar rcvf libsolar.a Solar_hour_angle.o Declination_angle.o
a - Solar_hour_angle.o
a - Declination_angle.o
[ese-zhangchjy@login03 fortran_demo1]$ gfortran Solar_elevation_angle.f90 -o Solar_elevation_angle.x -L. -lsolar
[ese-zhangchjy@login03 fortran_demo1]$ chmod 777 ./Solar_elevation_angle.x
[ese-zhangchjy@login03 fortran_demo1]$ ./Solar_elevation_angle.x
SEA for Shenzhen (22.542883N, 114.062996E) at 10:32 (Beijing time; UTC+8) on 2021-12-31: 36.635054661771022
[ese-zhangchjy@login03 fortran_demo1]$
```

将此输出结果与网站查询结果相对比

### Solar elevation angle calculator

Select the date & time and your timezone, enter your longitude & latitude to calculate the solar elevation angle (or solar latitude angle) and zenith angle.

Select date:	2021/12/31	
Enter time:	10:32	
Select time zone:	(UTC+08:00) Beijing, Chongqing, Hor 	
Enter latitude (e.g. Los Angeles: 34.052° N):	22.54288	North 
Enter longitude (e.g. Los Angeles: 118.24° W):	114.06299	East 
Solar elevation angle:	36.61°	
Solar zenith angle:	53.39°	