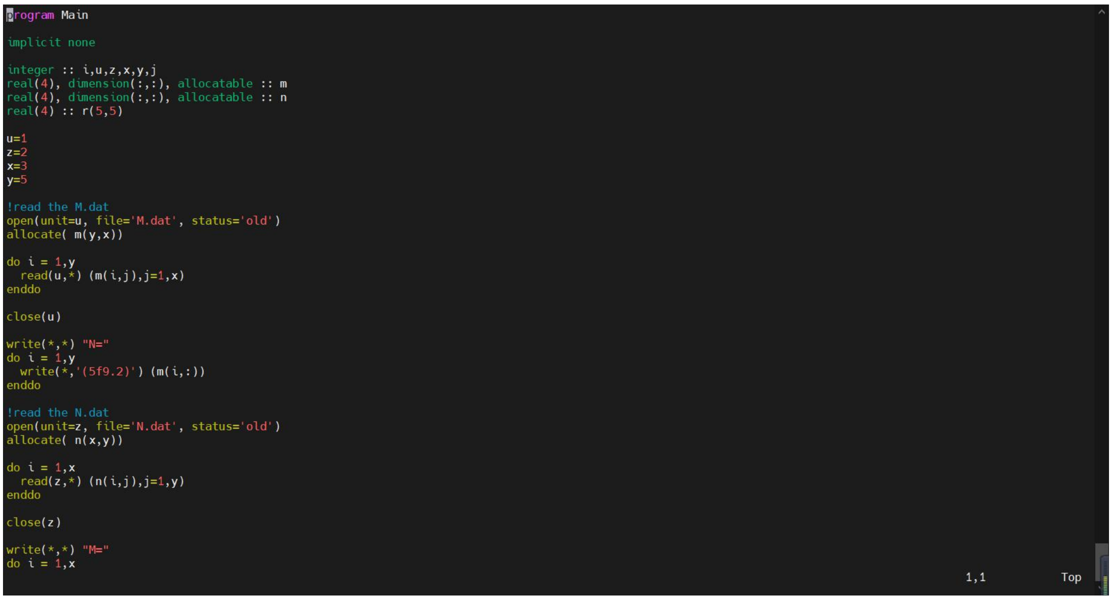
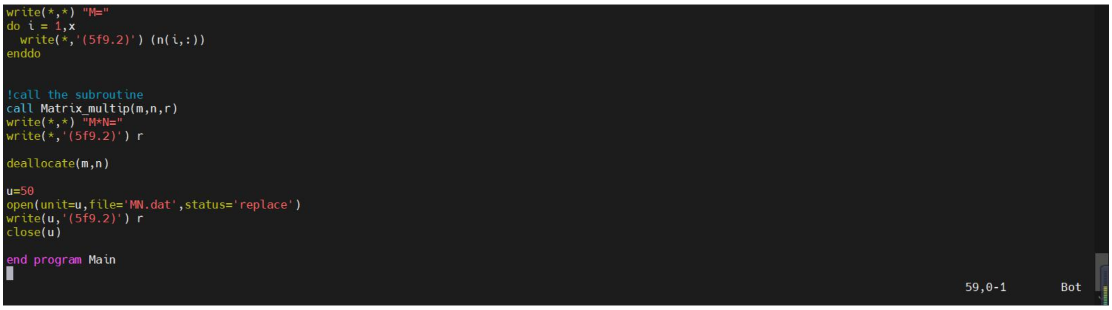
DENG Weihao (邓伟豪)'s TA report for assignment06
SID: 12132195
Github: https://github.com/Weihaodeng/ESE5023_Assignments_12132195
Responsible TA: HUANG Hao
Grade: 39

PS6

1.1

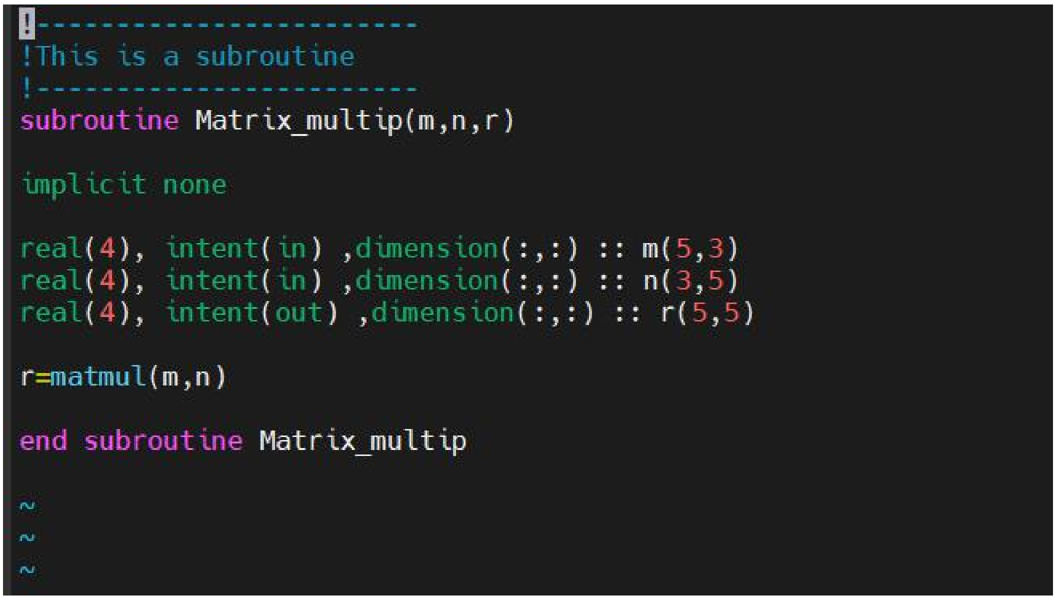


```
program Main

implicit none

integer :: i,u,z,x,y,j
real(4), dimension(:,:), allocatable :: m
real(4), dimension(:,:), allocatable :: n
real(4) :: r(5,5)

u=1
z=2
x=3
y=5

!read the M.dat
open(unit=u, file='M.dat', status='old')
allocate( m(y,x))

do i = 1,y
  read(u,*) (m(i,j),j=1,x)
enddo

close(u)

write(*,*) "N="
do i = 1,y
  write(*,'(5f9.2)') (m(i,:))
enddo

!read the N.dat
open(unit=z, file='N.dat', status='old')
allocate( n(x,y))

do i = 1,x
  read(z,*) (n(i,j),j=1,y)
enddo

close(z)

write(*,*) "M="
do i = 1,x
```



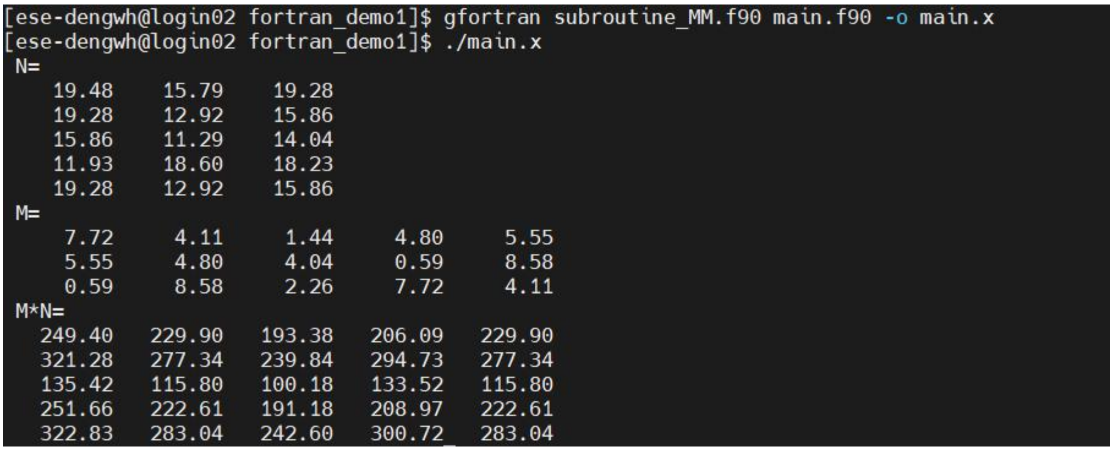
```
write(*,*) "M="
do i = 1,x
  write(*,'(5f9.2)') (n(i,:))
enddo


!call the subroutine
call Matrix_multip(m,n,r)
write(*,*) "M*N="
write(*,'(5f9.2)') r

deallocate(m,n)

u=50
open(unit=u,file='MN.dat',status='replace')
write(u,'(5f9.2)') r
close(u)

end program Main
```

1.2 I think you need to write some loops to calculate the matrix.

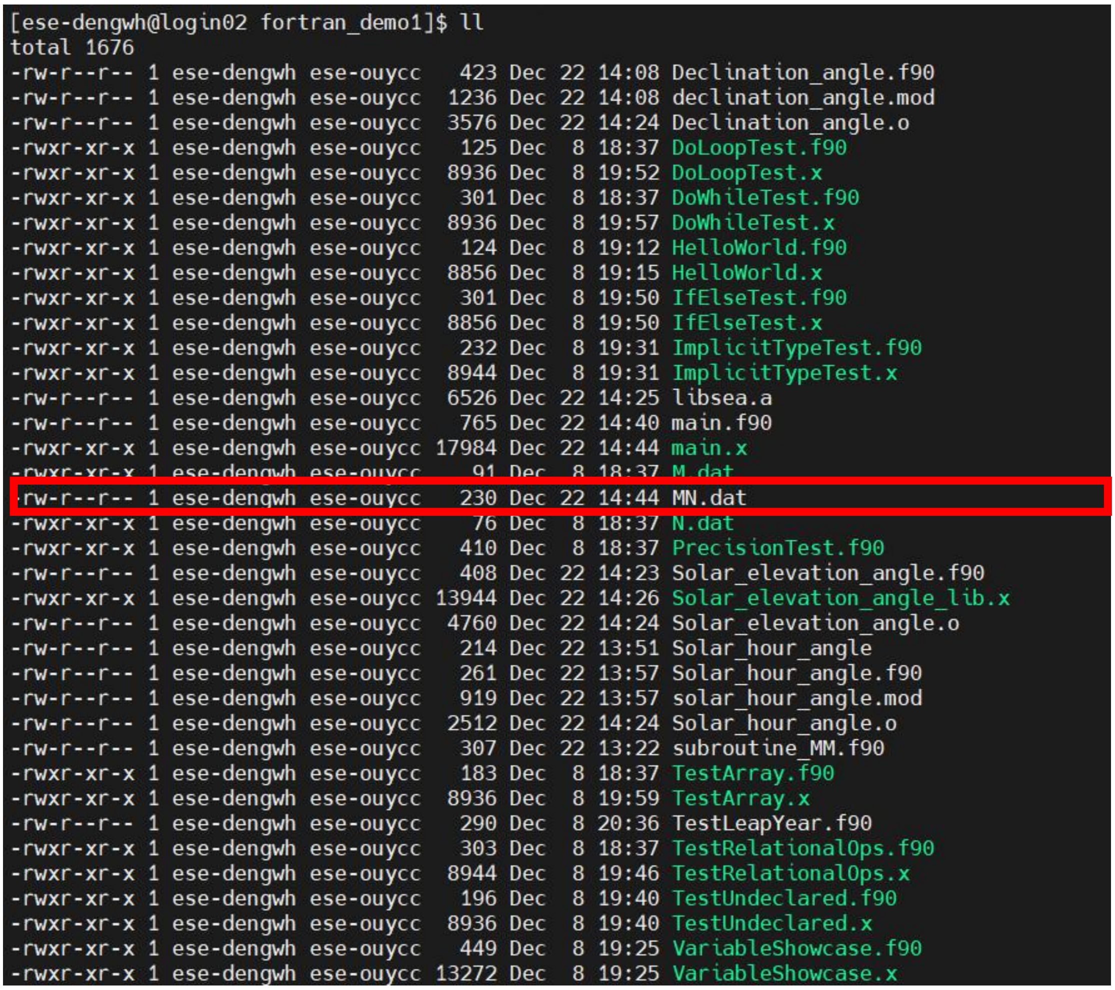


```
!------------------------
!This is a subroutine
!------------------------
subroutine Matrix_multip(m,n,r)

implicit none

real(4), intent(in) ,dimension(:,:) :: m(5,3)
real(4), intent(in) ,dimension(:,:) :: n(3,5)
real(4), intent(out) ,dimension(:,:) :: r(5,5)

r=matmul(m,n)

end subroutine Matrix_multip

~
~
~
```

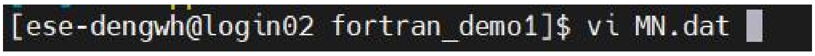
1.3 Good.



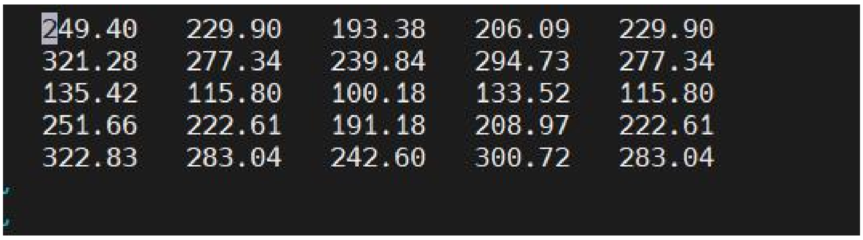
```
[ese-dengwh@login02 fortran_demo1]$ gfortran subroutine_MM.f90 main.f90 -o main.x
[ese-dengwh@login02 fortran_demo1]$ ./main.x
 N=
    19.48     15.79     19.28
    19.28     12.92     15.86
    15.86     11.29     14.04
    11.93     18.60     18.23
    19.28     12.92     15.86
 M=
     7.72      4.11      1.44      4.80      5.55
     5.55      4.80      4.04      0.59      8.58
     0.59      8.58      2.26      7.72      4.11
 M*N=
   249.40    229.90    193.38    206.09    229.90
   321.28    277.34    239.84    294.73    277.34
   135.42    115.80    100.18    133.52    115.80
   251.66    222.61    191.18    208.97    222.61
   322.83    283.04    242.60    300.72    283.04
```



```
[ese-dengwh@login02 fortran_demo1]$ ll
total 1676
-rw-r--r-- 1 ese-dengwh ese-ouycc   423 Dec 22 14:08 Declination_angle.f90
-rw-r--r-- 1 ese-dengwh ese-ouycc  1236 Dec 22 14:08 declination_angle.mod
-rw-r--r-- 1 ese-dengwh ese-ouycc  3576 Dec 22 14:24 Declination_angle.o
-rwxr-xr-x 1 ese-dengwh ese-ouycc   125 Dec  8 18:37 DoLoopTest.f90
-rwxr-xr-x 1 ese-dengwh ese-ouycc  8936 Dec  8 19:52 DoLoopTest.x
-rwxr-xr-x 1 ese-dengwh ese-ouycc   301 Dec  8 18:37 DoWhileTest.f90
-rwxr-xr-x 1 ese-dengwh ese-ouycc  8936 Dec  8 19:57 DoWhileTest.x
-rwxr-xr-x 1 ese-dengwh ese-ouycc   124 Dec  8 19:12 HelloWorld.f90
-rwxr-xr-x 1 ese-dengwh ese-ouycc  8856 Dec  8 19:15 HelloWorld.x
-rwxr-xr-x 1 ese-dengwh ese-ouycc   301 Dec  8 19:50 IfElseTest.f90
-rwxr-xr-x 1 ese-dengwh ese-ouycc  8856 Dec  8 19:50 IfElseTest.x
-rwxr-xr-x 1 ese-dengwh ese-ouycc   232 Dec  8 19:31 ImplicitTypeTest.f90
-rwxr-xr-x 1 ese-dengwh ese-ouycc  8944 Dec  8 19:31 ImplicitTypeTest.x
-rw-r--r-- 1 ese-dengwh ese-ouycc  6526 Dec 22 14:25 libsea.a
-rw-r--r-- 1 ese-dengwh ese-ouycc   765 Dec 22 14:40 main.f90
-rwxr-xr-x 1 ese-dengwh ese-ouycc 17984 Dec 22 14:44 main.x
-rwxr-xr-x 1 ese-dengwh ese-ouycc    91 Dec  8 18:37 M.dat
-rw-r--r-- 1 ese-dengwh ese-ouycc   230 Dec 22 14:44 MN.dat
-rwxr-xr-x 1 ese-dengwh ese-ouycc    76 Dec  8 18:37 N.dat
-rwxr-xr-x 1 ese-dengwh ese-ouycc   410 Dec  8 18:37 PrecisionTest.f90
-rw-r--r-- 1 ese-dengwh ese-ouycc   408 Dec 22 14:23 Solar_elevation_angle.f90
-rwxr-xr-x 1 ese-dengwh ese-ouycc 13944 Dec 22 14:26 Solar_elevation_angle_lib.x
-rw-r--r-- 1 ese-dengwh ese-ouycc  4760 Dec 22 14:24 Solar_elevation_angle.o
-rw-r--r-- 1 ese-dengwh ese-ouycc   214 Dec 22 13:51 Solar_hour_angle
-rw-r--r-- 1 ese-dengwh ese-ouycc   261 Dec 22 13:57 Solar_hour_angle.f90
-rw-r--r-- 1 ese-dengwh ese-ouycc   919 Dec 22 13:57 solar_hour_angle.mod
-rw-r--r-- 1 ese-dengwh ese-ouycc  2512 Dec 22 14:24 Solar_hour_angle.o
-rw-r--r-- 1 ese-dengwh ese-ouycc   307 Dec 22 13:22 subroutine_MM.f90
-rwxr-xr-x 1 ese-dengwh ese-ouycc   183 Dec  8 18:37 TestArray.f90
-rwxr-xr-x 1 ese-dengwh ese-ouycc  8936 Dec  8 19:59 TestArray.x
-rw-r--r-- 1 ese-dengwh ese-ouycc   290 Dec  8 20:36 TestLeapYear.f90
-rwxr-xr-x 1 ese-dengwh ese-ouycc   303 Dec  8 18:37 TestRelationalOps.f90
-rwxr-xr-x 1 ese-dengwh ese-ouycc  8944 Dec  8 19:46 TestRelationalOps.x
-rwxr-xr-x 1 ese-dengwh ese-ouycc   196 Dec  8 19:40 TestUndeclared.f90
-rwxr-xr-x 1 ese-dengwh ese-ouycc  8936 Dec  8 19:40 TestUndeclared.x
-rwxr-xr-x 1 ese-dengwh ese-ouycc   449 Dec  8 19:25 VariableShowcase.f90
-rwxr-xr-x 1 ese-dengwh ese-ouycc 13272 Dec  8 19:25 VariableShowcase.x
```

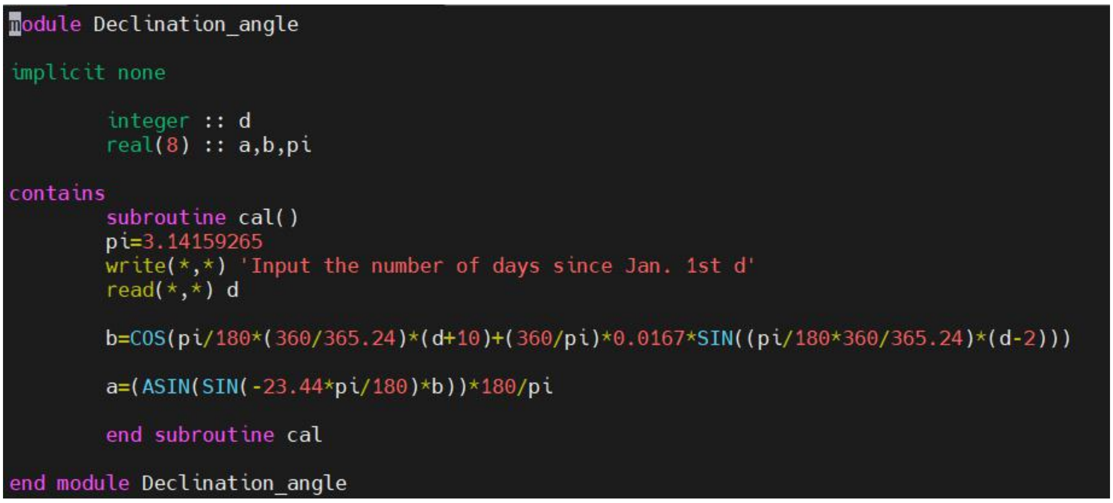


```
[ese-dengwh@login02 fortran_demo1]$ vi MN.dat
```



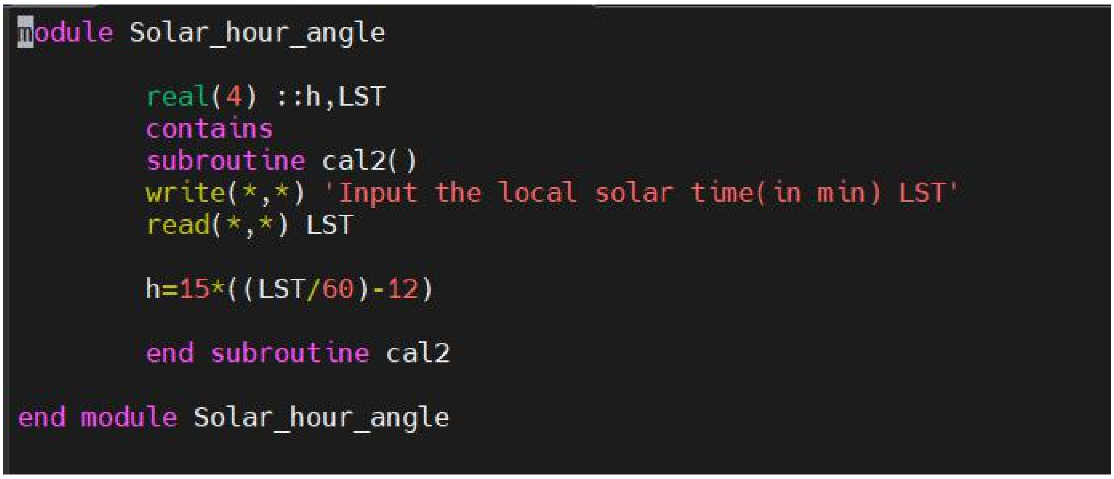
```
   249.40    229.90    193.38    206.09    229.90
   321.28    277.34    239.84    294.73    277.34
   135.42    115.80    100.18    133.52    115.80
   251.66    222.61    191.18    208.97    222.61
   322.83    283.04    242.60    300.72    283.04
```

2.1 I suggest you to use asind and sin, replacing asin(*180/pi) and sin(pi/180*).



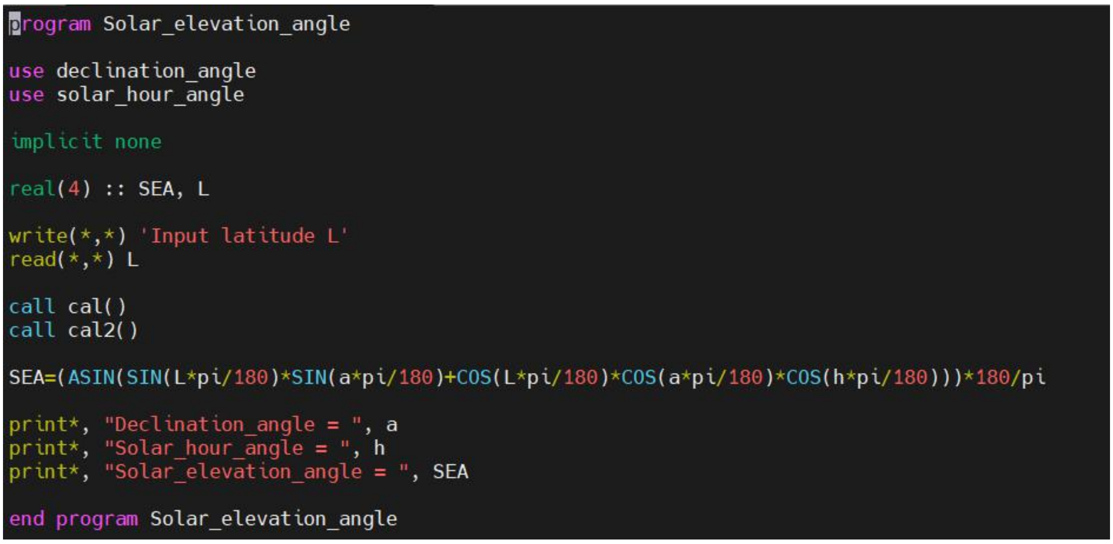
```
module Declination_angle

implicit none

        integer :: d
        real(8) :: a,b,pi

contains
        subroutine cal()
        pi=3.14159265
        write(*,*) 'Input the number of days since Jan. 1st d'
        read(*,*) d

        b=COS(pi/180*(360/365.24)*(d+10)+(360/pi)*0.0167*SIN((pi/180*360/365.24)*(d-2)))

        a=(ASIN(SIN(-23.44*pi/180)*b))*180/pi

        end subroutine cal

end module Declination_angle
```

2.2



```
module Solar_hour_angle

        real(4) ::h,LST
        contains
        subroutine cal2()
        write(*,*) 'Input the local solar time(in min) LST'
        read(*,*) LST

        h=15*((LST/60)-12)

        end subroutine cal2

end module Solar_hour_angle
```

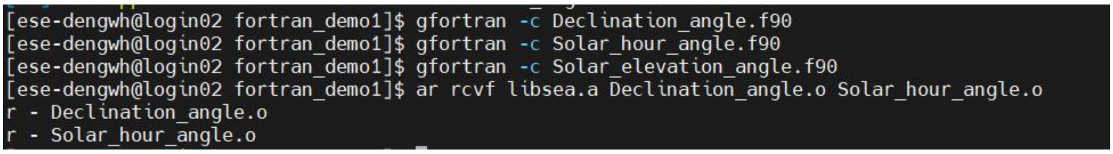
2.3 Again, I suggest you to use asind and sin, replacing asin(*180/pi) and sin(pi/180*).



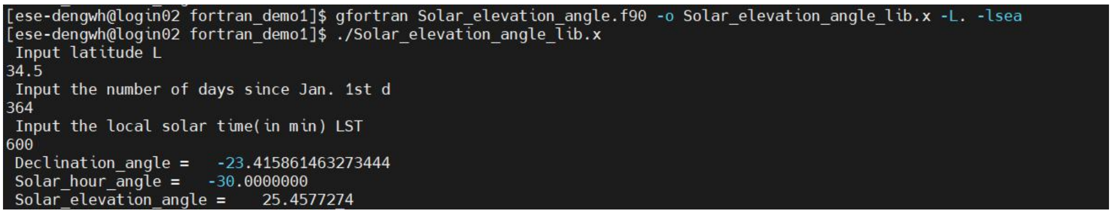
```
program Solar_elevation_angle

use declination_angle
use solar_hour_angle

implicit none

real(4) :: SEA, L

write(*,*) 'Input latitude L'
read(*,*) L

call cal()
call cal2()

SEA=(ASIN(SIN(L*pi/180)*SIN(a*pi/180)+COS(L*pi/180)*COS(a*pi/180)*COS(h*pi/180)))*180/pi

print*, "Declination_angle = ", a
print*, "Solar_hour_angle = ", h
print*, "Solar_elevation_angle = ", SEA

end program Solar_elevation_angle
```

2.4 (Kaifeng: 34.5°N, 2021-12-31, 10:00am)

why you calculate the SEA for Kaifeng? You should follow the question for Shenzhen. 1 point was deducted.



```
[ese-dengwh@login02 fortran_demo1]$ gfortran -c Declination_angle.f90
[ese-dengwh@login02 fortran_demo1]$ gfortran -c Solar_hour_angle.f90
[ese-dengwh@login02 fortran_demo1]$ gfortran -c Solar_elevation_angle.f90
[ese-dengwh@login02 fortran_demo1]$ ar rcvf libsea.a Declination_angle.o Solar_hour_angle.o
r - Declination_angle.o
r - Solar_hour_angle.o
```



```
[ese-dengwh@login02 fortran_demo1]$ gfortran Solar_elevation_angle.f90 -o Solar_elevation_angle_lib.x -L. -lsea
[ese-dengwh@login02 fortran_demo1]$ ./Solar_elevation_angle_lib.x
 Input latitude L
34.5
 Input the number of days since Jan. 1st d
364
 Input the local solar time(in min) LST
600
 Declination_angle =   -23.415861463273444
 Solar_hour_angle =   -30.0000000
 Solar_elevation_angle =    25.4577274
```