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得分：38/40

第一题（1-1、1-2、1-3）

```
[ese-jianglj@login02 ~]$ cp -r /work/ese-ouycc/fortran_demo1 .
[ese-jianglj@login02 ~]$ ll
total 265
drwxr-xr-x 10 ese-jianglj ese-ouycc  4096 Dec  8 10:27 data_demo
lrwxrwxrwx  1 ese-jianglj ese-ouycc     9 Dec  6 16:55 data_demo_link -> data_demo
-rw-r--r--  1 ese-jianglj ese-ouycc   515 Dec 17 17:33 Declination_angle.f90
-rw-r--r--  1 ese-jianglj ese-ouycc   405 Dec 17 17:33 declination_angle.mod
-rw-r--r--  1 ese-jianglj ese-ouycc  1800 Dec 17 17:33 Declination_angle.o
drwxr-xr-x  2 ese-jianglj ese-ouycc  4096 Nov  2 18:46 exam
drwxr-xr-x  3 ese-jianglj ese-ouycc  4096 Dec 17 20:04 fortran_demo1
drwxr-xr-x  5 ese-jianglj ese-ouycc  4096 Dec 17 16:34 fortran_demo2
-rw-r--r--  1 ese-jianglj ese-ouycc  4472 Dec 17 17:33 libsea.a
-rw-r--r--  1 ese-jianglj ese-ouycc  2216 Dec 18 22:12 Main.f90
-rw-r--r--  1 ese-jianglj ese-ouycc   230 Dec 18 22:23 MN.dat
-rw-------  1 ese-jianglj ese-ouycc   339 Dec 15 19:25 nano.save
-rw-r--r--  1 ese-jianglj ese-ouycc   245 Dec 17 17:44 order.txt
-rw-r--r--  1 ese-jianglj ese-ouycc   444 Dec 17 17:33 Solar_elevation_angle.f90
-rw-r--r--  1 ese-jianglj ese-ouycc 50392 Dec 17 17:33 Solar_elevation_angle.x
-rw-r--r--  1 ese-jianglj ese-ouycc   854 Dec 17 17:33 Solar_hour_angle.f90
-rw-r--r--  1 ese-jianglj ese-ouycc   405 Dec 17 17:33 solar_hour_angle.mod
-rw-r--r--  1 ese-jianglj ese-ouycc  2304 Dec 17 17:33 Solar_hour_angle.o
-rw-r--r--  1 ese-jianglj ese-ouycc     1 Dec 15 19:29 SubroutineTest.f90
-rw-r--r--  1 ese-jianglj ese-ouycc   272 Dec 17 17:25 Tset.f90
```

```
[ese-jianglj@login02 ~]$ cd fortran_demo1
[ese-jianglj@login02 fortran_demo1]$ ll
total 904
-rwxr-xr-x 1 ese-jianglj ese-ouycc  8816 Dec  8 20:19 a.out
-rw-r--r-- 1 ese-jianglj ese-ouycc   269 Dec 17 16:50 Ask.f90
-rwxr-xr-x 1 ese-jianglj ese-ouycc 13264 Dec 17 17:07 Ask.x
-rwxr-xr-x 1 ese-jianglj ese-ouycc   125 Dec 20 17:48 DoLoopTest.f90
-rwxr-xr-x 1 ese-jianglj ese-ouycc   346 Dec 20 17:48 DoWhileTest.f90
drwxr-xr-x 5 ese-jianglj ese-ouycc  4096 Dec 17 16:24 fortran_demo2
-rwxr-xr-x 1 ese-jianglj ese-ouycc   121 Dec 20 17:48 HelloWorld.f90
-rwxr-xr-x 1 ese-jianglj ese-ouycc  8816 Dec  8 20:17 HelloWorld.x
-rwxr-xr-x 1 ese-jianglj ese-ouycc   293 Dec 20 17:48 IfElseTest.f90
-rw-r--r-- 1 ese-jianglj ese-ouycc     0 Dec  8 20:34 ImplicitTypeTest
-rwxr-xr-x 1 ese-jianglj ese-ouycc   263 Dec 20 17:48 ImplicitTypeTest.f90
-rwxr-xr-x 1 ese-jianglj ese-ouycc    91 Dec 20 17:48 M.dat
-rwxr-xr-x 1 ese-jianglj ese-ouycc  8816 Dec  8 20:18 MyProgram.x
-rwxr-xr-x 1 ese-jianglj ese-ouycc    76 Dec 20 17:48 N.dat
-rwxr-xr-x 1 ese-jianglj ese-ouycc   410 Dec 20 17:48 PrecisionTest.f90
-rwxr-xr-x 1 ese-jianglj ese-ouycc  8976 Dec  8 20:31 PrecisionTest.x
-rwxr-xr-x 1 ese-jianglj ese-ouycc   183 Dec 20 17:48 TestArray.f90
-rw-r--r-- 1 ese-jianglj ese-ouycc   238 Dec 20 17:48 TestLeapYear.f90
-rwxr-xr-x 1 ese-jianglj ese-ouycc  8856 Dec 20 17:48 TestLeapYear.x
-rwxr-xr-x 1 ese-jianglj ese-ouycc   303 Dec 20 17:48 TestRelationalOps.f90
-rwxr-xr-x 1 ese-jianglj ese-ouycc   196 Dec 20 17:48 TestUndeclared.f90
-rwxr-xr-x 1 ese-jianglj ese-ouycc   488 Dec 20 17:48 VariableShowcase.f90
-rwxr-xr-x 1 ese-jianglj ese-ouycc 13232 Dec  8 20:28 VariableShowcase.x
```

```
program ReadAndCompute
    implicit none
    interface
        subroutine Matrix_multip(Matrix_M,Matrix_N,Matrix_MN,m,n)
            integer,intent(in) :: m,n
            real,allocatable,dimension(:,:),intent(in) ::  Matrix_M,Matrix_N
            real,allocatable,dimension(:,:),intent(out) :: Matrix_MN
            endsubroutine
    endinterface
    integer :: file_M,file_N,file_MN,m,n,l,i,j
    real,allocatable,dimension(:,:) :: Matrix_M_,Matrix_N_,Matrix_M,Matrix_N,Matrix_MN
    file_M=10
    file_N=20
    file_MN=30
    !read Matrix M
    m=5
    l=3
    n=5
    open(unit=file_M,file='M.dat')
    open(unit=file_N,file='N.dat')
    allocate(Matrix_M_(l,m))
    allocate(Matrix_N_(n,l))
    read(file_M,*) Matrix_M_
    read(file_N,*) Matrix_N_
    close(file_M)
    close(file_N)
    Matrix_M=transpose(Matrix_M_)
    Matrix_N=transpose(Matrix_N_)
    call Matrix_multip(Matrix_M,Matrix_N,Matrix_MN,m,n)
    !output Matrix_MN
    open(unit=file_MN,file='MN.dat')
    print *, "Matrix_MN:"
    do i=1,n
```

```
    do i=1,n
        do j=1,m
            write(*,'(f9.2)',advance='no') Matrix_MN(i,j)
            write(file_MN,'(f9.2)',advance='no') Matrix_MN(i,j)
        enddo
        write(*,*)
        write(file_MN,*)
    enddo
    close(file_MN)
end program ReadAndCompute
subroutine Matrix_multip(Matrix_M,Matrix_N,Matrix_MN,m,n)
    integer,intent(in) :: m,n
    real,allocatable,dimension(:,:),intent(in) ::  Matrix_M,Matrix_N
    real,allocatable,dimension(:,:),intent(out) :: Matrix_MN
    allocate(Matrix_MN(m,n))
    Matrix_MN=matmul(Matrix_M,Matrix_N)
end subroutine Matrix_multip
```

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
```

公式不对，-1，参考：

result = asin(sin(-23.44/180*pi)*cos(360.0/365.24*(d+10.0)/180*pi

+360.0/180*0.0167*sin(360.0/365.24*(d-2.0)/180*pi)))

result = result/pi*180

第二题

2-1

```
module Declination_angle
    implicit none
    real, parameter :: pi = 3.1415926536
    real, parameter :: temp = -0.3977885073979
    contains
      subroutine calu_dec_angle(days,sigma)
        implicit none
        real(8),intent(in) :: days
        real(8),intent(out) :: sigma
        sigma=asind(temp*cosd((360.0/365.24)*(days+10.0)+(360.0/pi)*0.0167*sind((360.0/365.24)*(days-2.0))))
        print *, "sigma = ", sigma
      end subroutine calu_dec_angle

end module Declination_angle
```

2-2

```
module Solar_hour_angle
    implicit none
    real, parameter :: pi = 3.1415926536
    contains
      subroutine calu_hour_angle(days,lst,longitude,tz,hour)
        implicit none
        real(8),intent(in) :: days,lst,longitude,tz
        real(8),intent(out) :: hour
        real(8) :: gamma,eot,offset,temp
        gamma=(2*pi/365.0)*(days-1+(lst-12.0)/24.0)
        eot=229.18*(0.000075+0.001816*cos(gamma)-0.032077*sin(gamma)-0.014615*cos(2*gamma)-0.040849*sin(2*gamma))
        offset=eot+4*(longitude-15*tz)
        temp=lst+offset/60.0
        hour=15*(temp-12)
        print *, "hour = ", hour
        !used for debug
        !print *, "gamma = ", gamma
        !print *, "eot = ", eot
        !print *, "offset = ", offset
        !print *, "temp = ", temp
      end subroutine calu_hour_angle

end module Solar_hour_angle
```

2-3

```
program SEA
    use Declination_angle
    use Solar_hour_angle
    implicit none
    real(8) :: days,lst,longitude,tz,hour,sigma,latitude,result
    days=327.0
    lst=15.5
    longitude=-118.24
    tz=-8
    latitude=32.22
    call calu_dec_angle(days,sigma)
    call calu_hour_angle(days,lst,longitude,tz,hour)
    result=asind(sind(latitude)*sind(sigma)+cosd(latitude)*cosd(sigma)*cosd(hour))
    print *, "result = ", result
end program SEA
```

2-4 结果有误，-1

创建在自己目录下

```
[ese-jianglj@login02 ~]$ cd /work/ese-jianglj/
[ese-jianglj@login02 ~]$ ll
total 265
drwxr-xr-x 10 ese-jianglj ese-ouycc  4096 Dec  8 10:27 data_demo
lrwxrwxrwx  1 ese-jianglj ese-ouycc     9 Dec  6 16:55 data_demo_link -> data_demo
-rw-r--r--  1 ese-jianglj ese-ouycc   515 Dec 17 17:33 Declination_angle.f90
-rw-r--r--  1 ese-jianglj ese-ouycc   405 Dec 17 17:33 declination_angle.mod
-rw-r--r--  1 ese-jianglj ese-ouycc  1800 Dec 17 17:33 Declination_angle.o
drwxr-xr-x  2 ese-jianglj ese-ouycc  4096 Nov  2 18:46 exam
drwxr-xr-x  3 ese-jianglj ese-ouycc  4096 Dec 17 20:04 fortran_demo1
drwxr-xr-x  5 ese-jianglj ese-ouycc  4096 Dec 17 16:34 fortran_demo2
-rw-r--r--  1 ese-jianglj ese-ouycc  4472 Dec 17 17:33 libsea.a
-rw-r--r--  1 ese-jianglj ese-ouycc  2216 Dec 18 22:12 Main.f90
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-rw-------  1 ese-jianglj ese-ouycc   339 Dec 15 19:25 nano.save
-rw-r--r--  1 ese-jianglj ese-ouycc   245 Dec 17 17:44 order.txt
-rw-r--r--  1 ese-jianglj ese-ouycc   444 Dec 17 17:33 Solar_elevation_angle.f90
-rw-r--r--  1 ese-jianglj ese-ouycc 50392 Dec 17 17:33 Solar_elevation_angle.x
-rw-r--r--  1 ese-jianglj ese-ouycc   854 Dec 17 17:33 Solar_hour_angle.f90
-rw-r--r--  1 ese-jianglj ese-ouycc   405 Dec 17 17:33 solar_hour_angle.mod
-rw-r--r--  1 ese-jianglj ese-ouycc  2304 Dec 17 17:33 Solar_hour_angle.o
-rw-r--r--  1 ese-jianglj ese-ouycc     1 Dec 15 19:29 SubroutineTest.f90
-rw-r--r--  1 ese-jianglj ese-ouycc   272 Dec 17 17:25 Tset.f90
```

打开 libsea.a 看是否成功

```
[ese-jianglj@login02 ~]$ ar tv libsea.a
rw-r--r-- 501/20   2304 Dec 15 22:02 2021 Solar_hour_angle.o
rw-r--r-- 501/20   1800 Dec 15 22:01 2021 Declination_angle.o
```