

PROBLEM: Consider the program given below:

```
program determinant
real, dimension(3,3) :: a
real :: ratio
integer :: i, j, s, n=3
a = reshape((/1.,0.,7.,2.,5.,8.,3.,6.,9./), (/3,3/))
print "(3f5.1)", (a(i,:), i=1,3)
print *, ""
do s = 1, 3
  do i = s+1, n
    ratio = a(i,s) / a(s,s)
    do j= s, n
      a(i,j) = a(i,j) - ratio * a(s,j)
    end do
  end do
end do
print "(3f5.1)", (a(i,:), i=1,3)
end program determinant
```

The program changes the matrix

$$a_{3 \times 3} = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

into upper triangular form by row and column operations to become

$$a_{3 \times 3} = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 5 & 6 \\ 0 & 0 & -4.8 \end{bmatrix}.$$

Since multiplying a row and adding the result to another row doesn't change the determinant of a matrix, the two matrices have the same determinant. The determinant of a in upper triangular form will be equal to the product of the diagonal elements. This program does not calculate the determinant of matrix a . However, it is obvious that making it into a program that does find the determinant is not difficult at all.

The problem here in this homework is to write a module containing a function that finds the determinant of a square matrix ($n \times n$) and a driver program to test the function.