```
************************************************************************************************************************************
 -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  - 
************************************************************************************************************************************
************************************************************************************************************************************
************************************************************************************************************************************
DATE: 05-03-2025 14:16:42     USER: FRTRN90     JOB: BNCHMRK                                                              PAGE: 0000



BNCHMRK   FRTRN90    FILE NAME/TYPE= TESTIN/TEST4.F90
BNCHMRK   FRTRN90
BNCHMRK   FRTRN90    CREATION DATE/TIME= 05-03-2025 14:16:42
BNCHMRK   FRTRN90
BNCHMRK   FRTRN90    FILE= 001   PAGES= 0002   LINES= 000082
BNCHMRK   FRTRN90
BNCHMRK   FRTRN90    SYSTEM= LINUX(6.12.13-AMD64)
BNCHMRK   FRTRN90
BNCHMRK   FRTRN90    SYSID= ACID   SYSUSER= ACID
BNCHMRK   FRTRN90
BNCHMRK   FRTRN90    FORM= WIDE
BNCHMRK   FRTRN90
BNCHMRK   FRTRN90    CHAR= FONTMONO
BNCHMRK   FRTRN90
BNCHMRK   FRTRN90    PRT1403 VERSION= 1.5.PRE-RELEASE



                               FFFFFFFFF RRRRRRRR  TTTTTTTT  RRRRRRRR  N      NN  9999999    00000
                               FFFFFFFFF RRRRRRRRR TTTTTTTT  RRRRRRRRR NN      NN 999999999  0000000
                               FF        RR     RR    TT     RR     RR NNN    NN 99     99 00     00
                               FF        RR     RR    TT     RR     RR NNNN   NN 99     99 00     00
                               FFFFFFFFF RRRRRRRRR    TT     RRRRRRRRR NN NN  NN 999999999 00     00
                               FFFFFFFFF RRRRRRRR     TT     RRRRRRRR  NN  NN NN  99999999 00     00
                               FF        RR  RR       TT     RR  RR    NN   NNNN        99 00     00
                               FF        RR   RR      TT     RR   RR   NN    NNN        99 00     00
                               FF        RR    RR     TT     RR    RR  NN     NN  99999999  0000000
                               FF        RR     RR    TT     RR     RR NN      N  9999999    00000


                               BBBBBBBB  N      NN  CCCCCCC  HH     HH M       M RRRRRRRR  KK     KK
                               BBBBBBBBB NN     NN CCCCCCCCC HH     HH MM     MM RRRRRRRRR KK    KK
                               BB     BB NNN    NN CC     CC HH     HH MMM   MMM RR     RR KK   KK
                               BB     BB NNNN   NN CC        HH     HH MMMM MMMM RR     RR KK  KK
                               BBBBBBBB  NN NN  NN CC        HHHHHHHHH MM MMM MM RRRRRRRR  KKKKK
                               BBBBBBBB  NN  NN NN CC        HHHHHHHHH MM  M  MM RRRRRRRR  KK  KK
                               BB     BB NN   NNNN CC        HH     HH MM     MM RR  RR    KK   KK
                               BB     BB NN    NNN CC     CC HH     HH MM     MM RR   RR   KK    KK
                               BBBBBBBBB NN     NN CCCCCCCCC HH     HH MM     MM RR    RR  KK     KK
                               BBBBBBBB  NN      N  CCCCCCC  HH     HH MM     MM RR     RR KK     KK


                                                     00000     00000       1
                                                    0000000   0000000     11
                                                   00     00 00     00   111
                                                   00     00 00     00    11
                                                   00     00 00     00    11
                                                   00     00 00     00    11
                                                   00     00 00     00    11
                                                   00     00 00     00    11
                                                    0000000   0000000   111111
                                                     00000     00000    111111


************************************************************************************************************************************
************************************************************************************************************************************
************************************************************************************************************************************
```

```
program lid_driven_cavity
  implicit none
  integer, parameter :: N = 50   ! grid size (NxN grid)
  real :: dx, dy, dt, Re        ! grid spacing, time step, Reynolds number
  real :: u(N, N), v(N, N), p(N, N)  ! velocity and pressure fields
  integer :: i, j, step
  real :: start_time, end_time, elapsed_time

  ! Parameters
  dx = 1.0 / (N-1)   ! Grid spacing in x direction
  dy = 1.0 / (N-1)   ! Grid spacing in y direction
  dt = 0.001         ! Time step size
  Re = 100           ! Reynolds number

  ! Initialize arrays
  u = 0.0
  v = 0.0
  p = 0.0

  ! Initialize the top boundary (lid) velocity
  u(N, :) = 1.0

  ! Start timing
  call cpu_time(start_time)

  ! Main loop for time stepping
  do step = 1, 1000
     call compute_velocity(u, v, p, dx, dy, dt, Re)
     call update_pressure(p, dx, dy)

     ! Output or check convergence
     if (mod(step, 100) == 0) then
         print *, 'Step: ', step
     end if
  end do

  ! Stop timing
  call cpu_time(end_time)
  elapsed_time = end_time - start_time
  print *, 'Elapsed time for CFD simulation: ', elapsed_time, ' seconds'

contains

  ! Function to update the velocity and pressure fields (simplified)
  subroutine compute_velocity(u, v, p, dx, dy, dt, Re)
    real, dimension(:,:), intent(inout) :: u, v, p
    real, intent(in) :: dx, dy, dt, Re
    integer :: i, j

    ! Simple explicit method for velocity (simplified)
    do i = 2, N-1
        do j = 2, N-1
            u(i, j) = u(i, j) - dt * ( (u(i, j) * (u(i+1, j) - u(i-1, j))) / (2*dx) + &
                                       (v(i, j) * (u(i, j+1) - u(i, j-1))) / (2*dy) )
        end do
    end do

    ! Simple velocity update for v (similar)
    do i = 2, N-1
        do j = 2, N-1
```

```
            v(i, j) = v(i, j) - dt * ( (u(i, j) * (v(i+1, j) - v(i-1, j))) / (2*dx) + &
                                       (v(i, j) * (v(i, j+1) - v(i, j-1))) / (2*dy) )
        end do
    end do
  end subroutine compute_velocity

  ! Function to solve for pressure (simplified Poisson equation solver)
  subroutine update_pressure(p, dx, dy)
    real, dimension(:,:), intent(inout) :: p
    real, intent(in) :: dx, dy
    integer :: i, j

    ! Simple pressure Poisson equation (Jacobi iteration)
    do i = 2, N-1
        do j = 2, N-1
            p(i, j) = 0.25 * ( p(i+1, j) + p(i-1, j) + p(i, j+1) + p(i, j-1) )
        end do
    end do
  end subroutine update_pressure

end program lid_driven_cavity
```