DATE: 14-02-2025 16:35:06 USER: FRTRN90 JOB: BNCHMRK PAGE: 0000 **BNCHMRK** FRTRN90 FILE NAME/TYPE= TESTIN/TEST4.F90 **BNCHMRK** FRTRN90 **BNCHMRK** FRTRN90 CREATION DATE/TIME= 14-02-2025 16:35:06 **BNCHMRK** FRTRN90 **BNCHMRK** FRTRN90 FILE= 001 PAGES= 0002 LINES= 000082 **BNCHMRK** FRTRN90 SYSTEM= LINUX(6.11.2-AMD64) BNCHMRK FRTRN90 **BNCHMRK** FRTRN90 SYSID= ACID SYSUSER= ACID **BNCHMRK** FRTRN90 **BNCHMRK** FRTRN90 **BNCHMRK** FRTRN90 FORM= STANDARD FRTRN90 BNCHMRK FRTRN90 CHAR= FONTMONO **BNCHMRK BNCHMRK** FRTRN90 PRT1403 VERSION= 1.3 **BNCHMRK** FRTRN90 26 27 FFFFFFFF RRRRRRR RRRRRRR NN 9999999 00000 29 TTTTTTT 30 NN 99999999 FFFFFFFF RRRRRRR TTTTTTT RRRRRRRR NN 0000000 RR RR TT RR RR NNN NN 99 99 00 00 FF RR RR RR RR NNNN NN 99 99 00 00 TT 34 FFFFFFFF RRRRRRRR RRRRRRRR NN NN NN 99999999 00 00 TT FFFFFFFF RRRRRRR TT RRRRRRRR NN NN 9999999 00 NN 00 RR RR TT RR RR NN NNNN 99 00 00 38 FF RR RRTT RR RR NN NNN 99 00 00 FF 99999999 RR RR NN 0000000 RR TT RR NN RR RR RR RR NN 9999999 00000 42 BBBBBBBB N CCCCCCC HH HH M M RRRRRRRR KK KK 45 46 NN CCCCCCCC HH MM RRRRRRRR KK BBBBBBBBB NN HH MM KK 47 BB NNN NN CC CC HH HH MMM MMM RR RR KK KK KK BB BB NNNN NN CC HH MMMM MMMM RR RR KK 49 BBBBBBBB NN NN NN CC HHHHHHHHH MM MMM MM RRRRRRRR KKKKK BBBBBBBB NN NN NN CC НННННННН MM М MM RRRRRRRR KK KK BB BB NN NNNN CC MM MM RR RR KK KK HH HH BB BB NN RR KK KK NNN CC CC HH HH MM MM RR BBBBBBBBB NN NN CCCCCCCC HH HH MM MM RR KK KK RR BBBBBBBB NN CCCCCCC HH HH MM MM RR RR KK KK 58 00000 00000 11 0000000 0000000 00 00 00 00 111 00 00 11 00 00 66 00 00 00 00 11 00 00 00 00 11 11 00 00 00 00 00 00 00 00 11 111111 0000000 0000000 00000 00000 111111

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program lid_driven_cavity
      implicit none
      integer, parameter :: N = 50  ! grid size (NxN grid)
                                      ! grid spacing, time step, Reynolds number
      real :: dx, dy, dt, Re
      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
                           ! Time step size
      dt = 0.001
      Re = 100
                           ! Reynolds number
                                                                                                                          18
      ! Initialize arrays
                                                                                                                          21
22
23
      u = 0.0
      v = 0.0
      p = 0.0
  18
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27
      ! Initialize the top boundary (lid) velocity
      u(N, :) = 1.0
                                                                                                                          29
30
      ! Start timing
                                                                                                                          31
      call cpu_time(start_time)
                                                                                                                          33
                                                                                                                          34
35
      ! Main loop for time stepping
      do step = 1, 1000
                                                                                                                          36
                                                                                                                          37
         call compute_velocity(u, v, p, dx, dy, dt, Re)
                                                                                                                          38
         call update_pressure(p, dx, dy)
                                                                                                                          39
  30
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         ! Output or check convergence
         if (mod(step, 100) == 0) then
    print *, 'Step: ', step
                                                                                                                          42
                                                                                                                          43
                                                                                                                          44
                                                                                                                          45
         end if
                                                                                                                          46
      end do
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      ! Stop timing
      call cpu_time(end_time)
                                                                                                                          51
      elapsed_time = end_time - start_time
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54
      print *, 'Elapsed time for CFD simulation: ', elapsed time, ' seconds'
    contains
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59
      ! Function to update the velocity and pressure fields (simplified)
      subroutine compute_velocity(u, v, p, dx, dy, dt, Re)
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62
        real, dimension(:,:), intent(inout) :: u, v, p
        real, intent(in) :: dx, dy, dt, Re
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        integer :: i, j
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67
        ! Simple explicit method for velocity (simplified)
        do i = 2, N-1
                                                                                                                          68
            do i = 2, N-1
                                                                                                                          69
                                                                                                                          70
                 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)
                                                                                                                          73
            end do
56
        end do
                                                                                                                          76
        ! Simple velocity update for v (similar)
                                                                                                                          78
        do i = 2, N-1
            do j = 2, N-1
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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))
                                                                                                                                   22
           end do
      end do
                                                                                                                                   25
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    end subroutine update_pressure
 end program lid_driven_cavity
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