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1. Task 1: Hello World

```
-bash-4.1$ whoami
tgupta5
-bash-4.1$ gfortran -fopenmp hello_world_openmp.f90 -o hello_world
-bash-4.1$ ./hello_world
 Hello World from thread =            4
 Hello World from thread =            1
 Hello World from thread =            7
 Hello World from thread =            0
 Number of threads =            8
 Hello World from thread =            3
 Hello World from thread =            5
 Hello World from thread =            2
 Hello World from thread =            6
-bash-4.1$
```

2. Task 2: Hello World

Analysis:

- “**OpenMP workshare**” performs better than “**OpenMP parallel do**” for all the matrix dimensions from 5*5 to 5000*5000.

- Also, the difference in performance proportionally increases with the size of the problem statement.

- Possible reasons for this can be that workshare is the inbuilt function, that has been optimized to the maximum level.

2.1 For Matrix with dimensions: A(5*5), B(5*5)

```
-bash-4.1$ whoami
tgupta5
-bash-4.1$
-bash-4.1$ gfortran -fopenmp matrix_op_openmp.f90 -o matrix_op_openmp
-bash-4.1$ ./matrix_op_openmp
 Please input the rows in matrix A:
5
 Please input the (columns in matrix A=rows in matrix B):
5
 Please input the columns in matrix B:
5
 -------------------------------------------------------------
 Dimentions of matriz A are: (           5 ,           5 )
 Dimentions of matriz B are: (           5 ,           5 )
 -------------------------------------------------------------
 -------------------------------------------------------------
 Time taken by OpenMP PARALLEL DO for matrix Mult is:   3.39664518833160400E-004  s
 -------------------------------------------------------------
 -------------------------------------------------------------
 Time taken by OpenMP workshare for matrix Mult is:   1.27777457237243652E-005  s
 -------------------------------------------------------------
 -------------------------------------------------------------
 MIN_ELEMENT IS:         6212  at position (           1 ,           1 )
 -------------------------------------------------------------
-bash-4.1$
```

2.2 For Matrix with dimensions: A(10*10), B(10*10)

```
-bash-4.1$ whoami
tgupta5
-bash-4.1$ ./matrix_op_openmp
 Please input the rows in matrix A:
10
 Please input the (columns in matrix A=rows in matrix B):
10
 Please input the columns in matrix B:
10
 -------------------------------------------------------------
 Dimentions of matriz A are: (          10 ,          10 )
 Dimentions of matriz B are: (          10 ,          10 )
 -------------------------------------------------------------
 -------------------------------------------------------------
 Time taken by OpenMP PARALLEL DO for matrix Mult is:   3.37421894073486328E-004  s
 -------------------------------------------------------------
 -------------------------------------------------------------
 Time taken by OpenMP workshare for matrix Mult is:   1.48564577102661133E-005  s
 -------------------------------------------------------------
 -------------------------------------------------------------
 MIN_ELEMENT IS:         9049  at position (          10 ,          10 )
 -------------------------------------------------------------
```

2.3 For Matrix with dimensions: A(50*50), B(50*50)

```
[-bash-4.1$ whoami
 tgupta5
[-bash-4.1$ ./matrix_op_openmp
  Please input the rows in matrix A:
[50
  Please input the (columns in matrix A=rows in matrix B):
[50
  Please input the columns in matrix B:
[50
  ---------------------------------------------------------------------
  Dimentions of matriz A are: (          50 ,          50 )
  Dimentions of matriz B are: (          50 ,          50 )
  ---------------------------------------------------------------------
  ---------------------------------------------------------------------
  Time taken by OpenMP PARALLEL DO for matrix Mult is:   8.12292098999023438E-004  s
  ---------------------------------------------------------------------
  ---------------------------------------------------------------------
  Time taken by OpenMP workshare for matrix Mult is:   1.53355300426483154E-004  s
  ---------------------------------------------------------------------
  ---------------------------------------------------------------------
  MIN_ELEMENT IS:        70401  at position (          33 ,          33 )
  ---------------------------------------------------------------------
-bash-4.1$
```

2.4 For Matrix with dimensions: A(100*100), B(100*100)

```
[-bash-4.1$ whoami
 tgupta5
[-bash-4.1$ ./matrix_op_openmp
  Please input the rows in matrix A:
[100
  Please input the (columns in matrix A=rows in matrix B):
[100
  Please input the columns in matrix B:
[100
  ---------------------------------------------------------------------
  Dimentions of matriz A are: (         100 ,         100 )
  Dimentions of matriz B are: (         100 ,         100 )
  ---------------------------------------------------------------------
  ---------------------------------------------------------------------
  Time taken by OpenMP PARALLEL DO for matrix Mult is:   3.38096171617507935E-003  s
  ---------------------------------------------------------------------
  ---------------------------------------------------------------------
  Time taken by OpenMP workshare for matrix Mult is:   1.37490779161453247E-003  s
  ---------------------------------------------------------------------
  ---------------------------------------------------------------------
  MIN_ELEMENT IS:       164293  at position (          83 ,          83 )
  ---------------------------------------------------------------------
-bash-4.1$
```

2.5 For Matrix with dimensions: A(500*500), B(500*500)

```
[-bash-4.1$ whoami
 tgupta5
[-bash-4.1$ ./matrix_op_openmp
  Please input the rows in matrix A:
[500
  Please input the (columns in matrix A=rows in matrix B):
[500
  Please input the columns in matrix B:
[500
  ------------------------------------------------------------------
  Dimentions of matriz A are: (         500 ,         500 )
  Dimentions of matriz B are: (         500 ,         500 )
  ------------------------------------------------------------------
  ------------------------------------------------------------------
  Time taken by OpenMP PARALLEL DO for matrix Mult is:   0.36238139867782593       s
  ------------------------------------------------------------------
  ------------------------------------------------------------------
  Time taken by OpenMP workshare for matrix Mult is:   0.16553945839405060       s
  ------------------------------------------------------------------
  ------------------------------------------------------------------
  MIN_ELEMENT IS:      1059260  at position (         159 ,         159 )
  ------------------------------------------------------------------
 -bash-4.1$
```

2.6 For Matrix with dimensions: A(1000*1000), B(1000*1000)

```
[-bash-4.1$ whoami
 tgupta5
[-bash-4.1$ ./matrix_op_openmp
  Please input the rows in matrix A:
[1000
  Please input the (columns in matrix A=rows in matrix B):
[1000
  Please input the columns in matrix B:
[1000
  ------------------------------------------------------------------
  Dimentions of matriz A are: (        1000 ,        1000 )
  Dimentions of matriz B are: (        1000 ,        1000 )
  ------------------------------------------------------------------
  ------------------------------------------------------------------
  Time taken by OpenMP PARALLEL DO for matrix Mult is:    2.9832803010940552       s
  ------------------------------------------------------------------
  ------------------------------------------------------------------
  Time taken by OpenMP workshare for matrix Mult is:    1.3741686120629311       s
  ------------------------------------------------------------------
  ------------------------------------------------------------------
  MIN_ELEMENT IS:      2223174  at position (         819 ,         819 )
  ------------------------------------------------------------------
 -bash-4.1$
```

2.6 For Matrix with dimensions: A(5000*1000), B(5000*1000)

```
[-bash-4.1$ whoami
 tgupta5
[-bash-4.1$ ./matrix_op_openmp
  Please input the rows in matrix A:
[5000
  Please input the (columns in matrix A=rows in matrix B):
[5000
  Please input the columns in matrix B:
[5000
  ---------------------------------------------------------------
  Dimentions of matriz A are: (        5000 ,        5000 )
  Dimentions of matriz B are: (        5000 ,        5000 )
  ---------------------------------------------------------------
  ---------------------------------------------------------------
  Time taken by OpenMP PARALLEL DO for matrix Mult is:    685.29794872552156       s
  ---------------------------------------------------------------
  ---------------------------------------------------------------
  Time taken by OpenMP workshare for matrix Mult is:    291.12312591820955       s
  ---------------------------------------------------------------
  ---------------------------------------------------------------
  MIN_ELEMENT IS:     11927617  at position (        2610 ,        2610 )
  ---------------------------------------------------------------
```