**Program-10**

**Write an OpenACC program that computes a simple matrix-matrix multiplication using dynamic memory allocation.**

#include <sys/time.h>

#include<stdlib.h>

#include <stdio.h>

#define MAX 1000

int SIZE;

double \*\*a,\*\*b,\*\*c,\*\*d;

int main(int argc, char\* argv[])

{

SIZE=atoi(argv[1]);

a = (double\*\*)malloc(SIZE\*sizeof (double));

b = (double\*\*)malloc(SIZE\*sizeof (double));

c = (double\*\*)malloc(SIZE\*sizeof (double));

d = (double\*\*)malloc(SIZE\*sizeof (double));

int i,j,k;

struct timeval tim;

double t1, t2, tmp;

// Initialize matrices.

for (i = 0; i < SIZE; ++i) {

a[i] = (double\*)malloc(SIZE\*sizeof(double)); b[i] = (double\*)malloc(SIZE\*sizeof(double));

c[i] = (double\*)malloc(SIZE\*sizeof(double)); d[i] = (double\*)malloc(SIZE\*sizeof(double));

for (j = 0; j < SIZE; ++j) {

a[i][j] = (double)(i + j);

b[i][j] = (double)(i - j);

c[i][j] = 0.0f;

d[i][j] = 0.0f;

}

}

for (i = 0; i < SIZE; ++i) {

for (j = 0; j < SIZE; ++j) {

tmp=0.0f;

for (k = 0; k < SIZE; ++k) {

tmp += a[i][k] \* b[k][j];

}

d[i][j] = tmp;

}

}

// Time stamp t1

gettimeofday(&tim, NULL);

t1=tim.tv\_sec+(tim.tv\_usec/1000000.0);

// Compute matrix multiplication.

#pragma acc data copyin(a,b) copy(c)

#pragma acc kernels

#pragma acc loop tile(1000,1000)

for (i = 0; i < SIZE; ++i) {

for (j = 0; j < SIZE; ++j) {

tmp=0.0f;

#pragma acc loop reduction(+:tmp)

for (k = 0; k < SIZE; ++k) {

tmp += a[i][k] \* b[k][j];

}

c[i][j] = tmp;

}

}

// Time stamp t2, elapsed time OpenACC

gettimeofday(&tim, NULL);

t2=tim.tv\_sec+(tim.tv\_usec/1000000.0);

printf("%.6lf seconds with OpenACC \n", t2-t1);

// Check the OpenACC result matrix

for (i = 0; i < SIZE; ++i)

for (j = 0; j < SIZE; ++j)

if(c[i][j] != d[i][j]) {

printf("Error %d %d %f %f \n", i,j, c[i][j], d[i][j]);

exit(1);

}

printf("OpenACC matrix multiplication test was successful!\n");

return 0;

}



