INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR
Department of Computer Science and Engineering
Mid Spring Semester Examination, 2016-17

Date: 16-Feb-17   **Time: 2pm – 4pm**
No. of Students: 22   **Full Marks: 60**

Subject: High Performance Parallel Programming (CS61064)

Write a program in openMP to perform the following:

Construct a 1D array *A* that contains first 1000 non-Fibonacci numbers starting from 1 as per their order of appearances. Construct another 1D array *B* that contains first 1000 non-Fibonacci numbers starting from 20 as per their order of appearances. Compute and print the sample Pearson Correlation coefficient among the elements of *A* and *B*. Consider existence of a one-to-one correspondence between array *A* and *B*.

Upload in Moodle:
    Documented openMP source code.

Marking Scheme:
    1. Generating array *A* using for loop with dynamic scheduling.   **10**
    2. Generating array *B* using for loop with static scheduling.   **10**
    3. Compute the sample Pearson Correlation coefficient   **20**
    4. Completeness of the program   **10**
    5. Report and scalability   **10**

                                                     Total: **60**

Report on Answer script:
    1. Provide specification of your system including number of processors.

    Hints:
        System specification:
            cat /proc/cpuinfo

2. Prepare a table like one given below. Report wall-clock time required by your program.

Step	Vary thread number				openMP facility used
	1	2	4	8	
Generating array *A* using for loop with dynamic scheduling. Your chunk size: _____					
Generating array *B* using for loop with static scheduling. Your chunk size: _____					
Compute the sample Pearson Correlation coefficient.					
Total time required					

3. Comment on the scalability of your program using your data.

Hints:

Fibonacci numbers: In mathematics, the Fibonacci numbers are the numbers in the following integer sequence, called the Fibonacci sequence, and characterized by the fact that every number after the first two is the sum of the two preceding ones:

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, …..

By definition, the first two numbers in the Fibonacci sequence are 1 and 1, depending on the chosen starting point of the sequence, and each subsequent number is the sum of the previous two.

Mathematically,

$F_n = F_{n-1} + F_{n-2}$, $F_1 = 1$, $F_2 = 1$;

Sample Pearson correlation coefficient:

$$\rho_{ab} = \frac{n\sum a_i b_i - \sum a_i \sum b_i}{\sqrt{n\sum a_i^2 - (\sum a_i)^2}\ \sqrt{n\sum b_i^2 - (\sum b_i)^2}}$$

where *n* is the size of the array *A* and *B* whose *i*-th elements is a_i and b_i, respectively.