National University of Computer and Emerging Sciences, Lahore Campus

Course:	Parallel and Distributed Computing	Course Code:	CS-3006
Program:	BSCS & BSDS	Semester:	Spring 2024
Duration:	7 Days	Total Marks:	30
Submit Date:	02-Apr-2024	Weight	1.25%
Type:	Announced	Page(s):	3
Exam:	Assignment 03	Section:	

Name & Roll No:

Submission Mode & Time: Handwritten solutions on A4 papers to be submitted during the lecture. You must have to write all the steps involved in the solution. State your answers in the readable handwriting and with the help of diagrams, where necessary.

Question # 1: **[6 marks, CLO # 2]**

Provide the output of the given code considering compiler will generate maximum 4 threads if dynamic adjustment is enabled.

```
workers = omp_get_max_threads();          //can use num_procs

printf ("%d maximum allowed threads\n", workers);

printf ("Total number of allocated cores are:%d\n", omp_get_num_procs());

omp_set_dynamic(1);          // dynamic adjustment enabled

omp_set_num_threads(8);

printf ("Total number of requested when dynamic is true are:%d\n", 1);

#pragma omp parallel {

        #pragma omp single nowait

        printf("Total threads in parallel region1=%d:\n", omp_get_num_threads());

        #pragma omp for

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

        {a = complex_func();}

 }

omp_set_dynamic(0);          // dynamic adjustment disabled
```

```
omp_set_num_threads(6);
printf("Total number of requested when dynamic is false are:%d\n", 6);
#pragma omp parallel
{
#pragma omp single nowait
printf("Total threads in parallel region2=%d:\n", omp_get_num_threads());
#pragma omp for
for (i = 0; i < mult; i++)
{a = complex_func();}
}
```

Output:

Question # 2: **[8 marks, CLO # 3]**

Perform all-to-all broadcast on 8 nodes ring structure. Write all the seven communication steps and the final state.

Question # 3: **[8 marks, CLO # 3]**

Perform prefix-sum operation on 3-D hypercube structure. Write all the steps involved and final state.

Question # 4: **[2 + 3 + 3 marks, CLO # 3]**

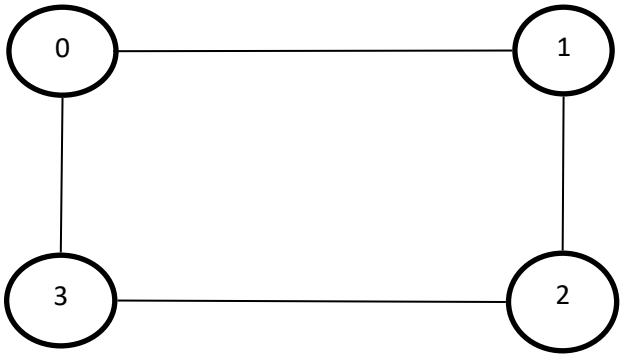
Assume we have a 4*4 matrix with the following values:

2 4 6 8
1 3 5 7
10 12 14 16
11 13 15 17

Assume each row is stored at different processes, row 1 (2, 4, 6, 8) is stored at process P0, row 2 at P1, row 3 at P2, and row 4 (11, 13, 15, 17) at P3. We want to apply a matrix transpose. Describe:

(i) The operation that needs to take place

(ii) Draw the message originating from process P0 and show what happens at each step with this message



(iii) Draw the message originating from process P3 and show what happens at each step with this message