Nagar Yuwak Shikshan Sanstha's
Yeshwantrao Chavan College of Engineering
(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)
Hingna Road, Wanadongri, Nagpur - 441 110
NAAC A++
Ph.: 07104-237919, 234623, 329249, 329250 Fax: 07104-232376, Website: www.ycce.edu

Department of Computer Technology

Vision of the Department

To be a well-known centre for pursuing computer education through innovative pedagogy, value-based education and industry collaboration.

Mission of the Department

To establish learning ambience for ushering in computer engineering professionals in core and multidisciplinary area by developing Problem-solving skills through emerging technologies.

Session 2025-2026

Vision: Dream of where you want.	**Mission:** Means to achieve Vision

Program Educational Objectives of the program (PEO): (broad statements that describe the professional and career accomplishments)

PEO1	**Preparation**	**P: Preparation**	**Pep-CL abbreviation pronounce as Pep-si-lL easy to recall**
PEO2	**Core Competence**	**E: Environment (Learning Environment)**	
PEO3	**Breadth**	**P: Professionalism**	
PEO4	**Professionalism**	**C: Core Competence**	
PEO5	**Learning Environment**	**L: Breadth (Learning in diverse areas)**	

Program Outcomes (PO): (statements that describe what a student should be able to do and know by the end of a program)

Keywords of POs:
Engineering knowledge, Problem analysis, Design/development of solutions, Conduct Investigations of Complex Problems, Engineering Tool Usage, The Engineer and The World, Ethics, Individual and Collaborative Team work, Communication, Project Management and Finance, Life-Long Learning

PSO Keywords: Cutting edge technologies, Research

"I am an engineer, and I know how to apply engineering knowledge to investigate, analyse and design solutions to complex problems using tools for entire world following all ethics in a collaborative way with proper management skills throughout my life." *to contribute to the development of cutting-edge technologies and Research*.

Integrity: I will adhere to the Laboratory Code of Conduct and ethics in its entirety.

Name and Signature of Student and Date
(Signature and Date in Handwritten)

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Session	**2025-26 (ODD)**	**Course Name**	**HPC Lab**
Semester	**7**	**Course Code**	**22ADS706**
Roll No	**03**	**Name of Student**	**Debasrita Chattopadhyay**

Practical Number	**03**
Course Outcome	1. Understand and Apply Parallel Programming Concepts 2. Analyze and Improve Program Performance. 3. Demonstrate Practical Skills in HPC Tools and Environments.
Aim	Introduction to OpenMP
Problem Definition	Implement: Part I: - OpenMP (Open Multi-Processing) Part II: - Example 1: OpenMP Scheduling Clause Example 2: Using Barrier for Synchronization Example 3: Nested Parallelism
Theory (100 words)	OpenMP (Open Multi-Processing) is an API (Application Programming Interface) that supports parallel programming in C, C++, and Fortran on shared-memory architectures. It provides a set of compiler directives, runtime library routines, and environment variables that enable programmers to write applications that can run on multiple processors simultaneously. OpenMP follows the fork-join model of parallelism: When a parallel region is encountered, the master thread forks into multiple threads that run concurrently. At the end of the parallel region, the threads join back into a single thread (the master). **Key Features** 1. Ease of Use – Uses simple compiler directives (#pragma omp in C/C++) to parallelize code without major modifications. 2. Shared Memory Model – All threads share the same memory address space, making communication easy.

	3. Scalability – Programs can scale with the number of available processors. 4. Portability – Supported by most modern compilers (e.g., GCC, Intel, Clang). 5. Incremental Parallelism – Developers can parallelize code step by step.
Procedure and Execution (100 Words)	Algorithm: Step 1: Install GCC with OpenMP support Most CentOS systems have GCC preinstalled. If not: sudo yum install gcc To verify OpenMP support: gcc -fopenmp –version Step 2: Write the OpenMP Program Create a file named openmp_example.c. nano openmp_example.c Paste your OpenMP C code (example below). Step 3: Compile the Program Use -fopenmp flag to enable OpenMP: gcc -fopenmp -o openmp_example openmp_example.c Step 4: Set Number of Threads (Optional) You can set how many threads OpenMP should use: export OMP_NUM_THREADS=4 Step 5: Run the Program ./openmp_example
	Code: **Part 1** **// File: openmp_example.c** #include <stdio.h> #include <omp.h> int main() { int i; int n = 10; int a[10]; // Parallel region

```
#pragma omp parallel for
for (i = 0; i &lt; n; i++) {
a[i] = i * i;
printf(&quot;Thread %d: a[%d] = %d\n&quot;,
omp_get_thread_num(), i, a[i]);
}

return 0;
}
```

Part II:-

Example 1: OpenMP Scheduling Clause

```
#include &lt;stdio.h&gt;
#include &lt;omp.h&gt;
int main() {
int i;
int n = 12;
#pragma omp parallel for schedule(static, 3)
for (i = 0; i &lt; n; i++) {
printf(&quot;Thread %d processing iteration %d\n&quot;,
omp_get_thread_num(), i);
}
return 0;
}
```

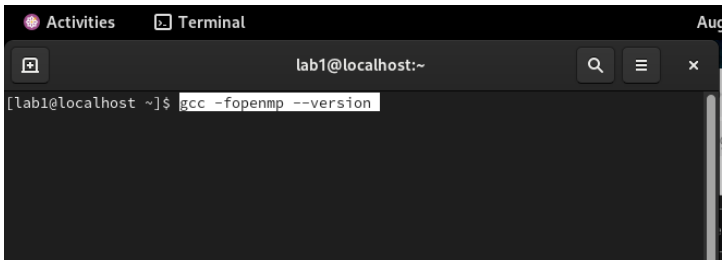
Example 2: Using Barrier for Synchronization

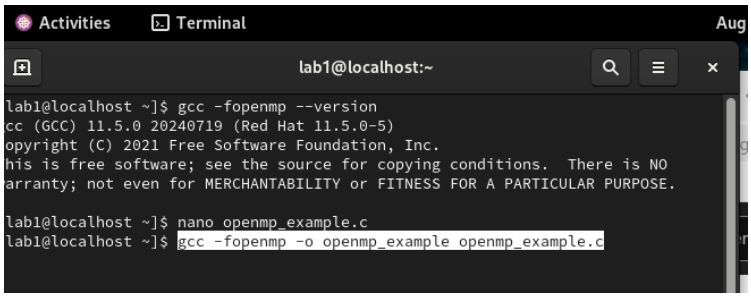
```
#include &lt;stdio.h&gt;
#include &lt;omp.h&gt;
int main() {
#pragma omp parallel num_threads(4)
{
int id = omp_get_thread_num();

printf(&quot;Thread %d before barrier\n&quot;, id);
#pragma omp barrier
if (id == 0) {
printf(&quot;All threads reached the barrier. Thread %d
continuing.\n&quot;, id);
}
}
return 0;
}
```

Example 3: Nested Parallelism

```
#include &lt;stdio.h&gt;
#include &lt;omp.h&gt;
int main() {
omp_set_nested(1); // Enable nested parallelism
#pragma omp parallel num_threads(2)
{
int id = omp_get_thread_num();
printf(&quot;Outer thread %d starting\n&quot;, id);
#pragma omp parallel num_threads(2)
{
int inner_id = omp_get_thread_num();
printf(&quot; Inner thread %d of outer thread %d\n&quot;,
inner_id, id);
}
}
return 0;
}
```

Output:





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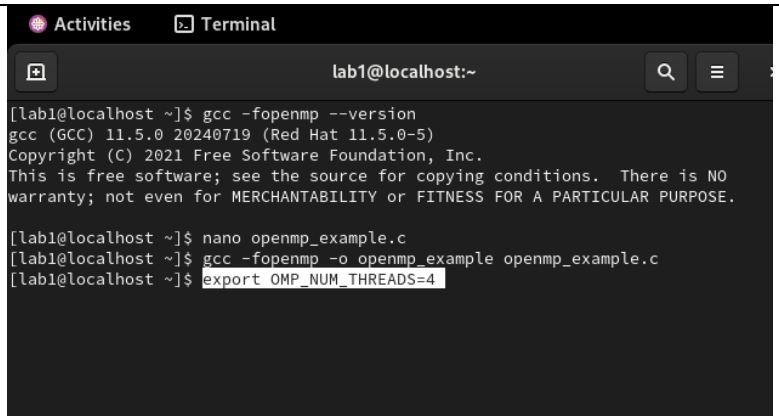

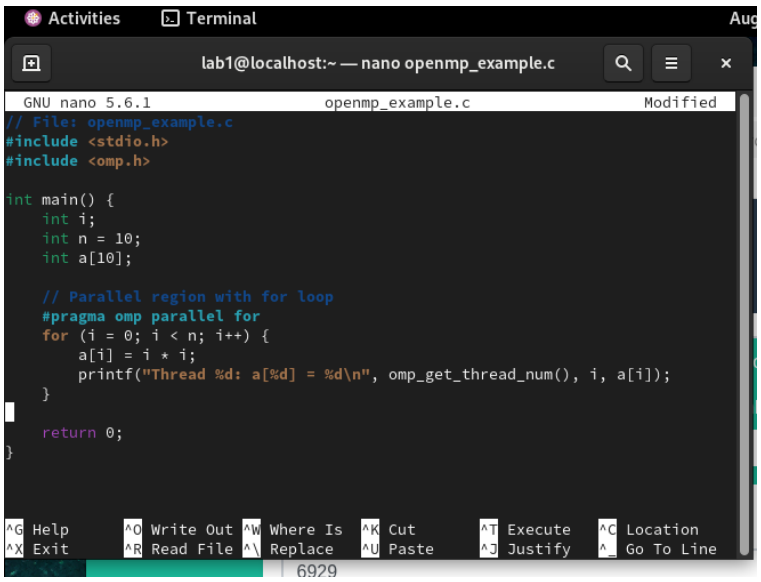

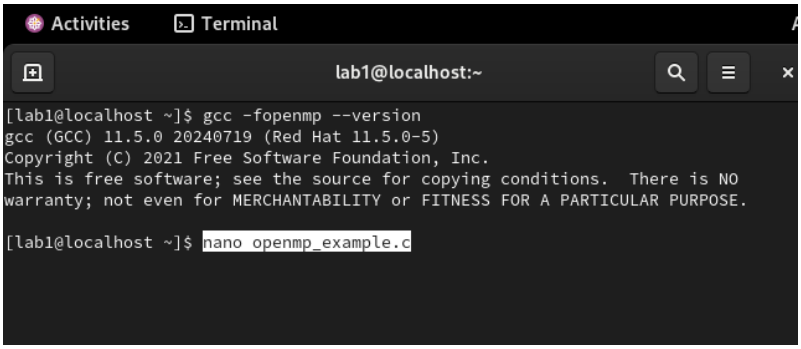

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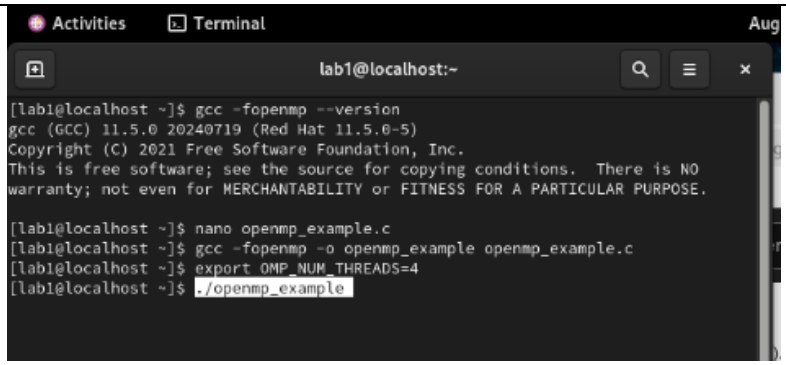

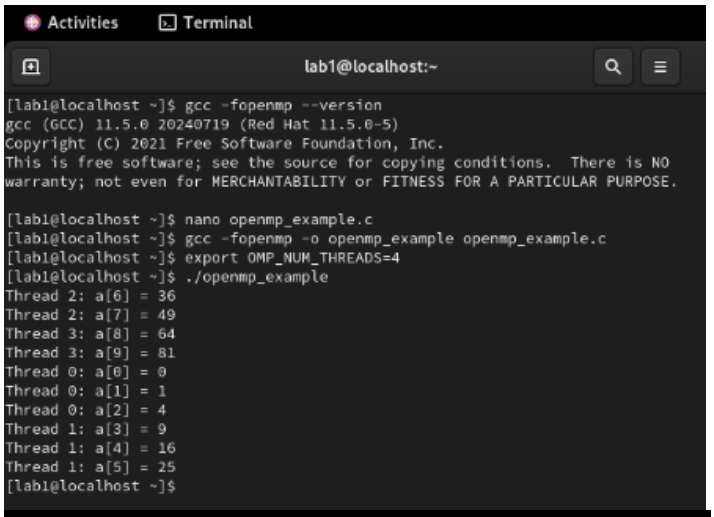

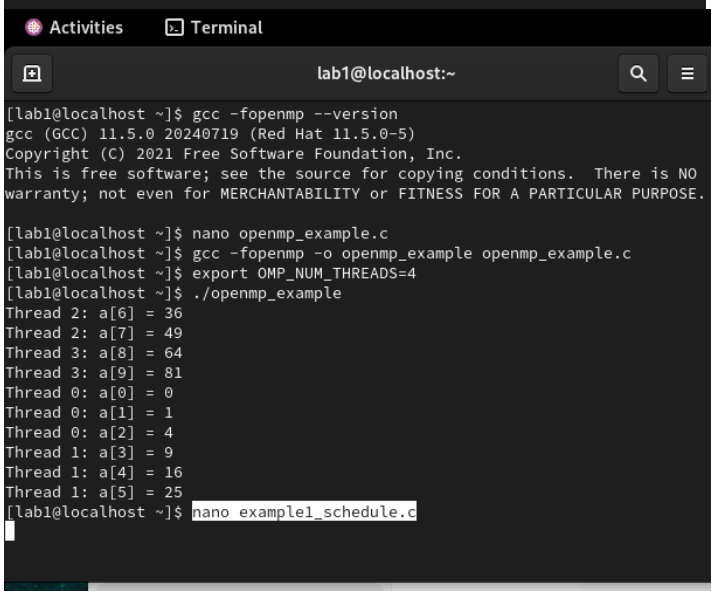

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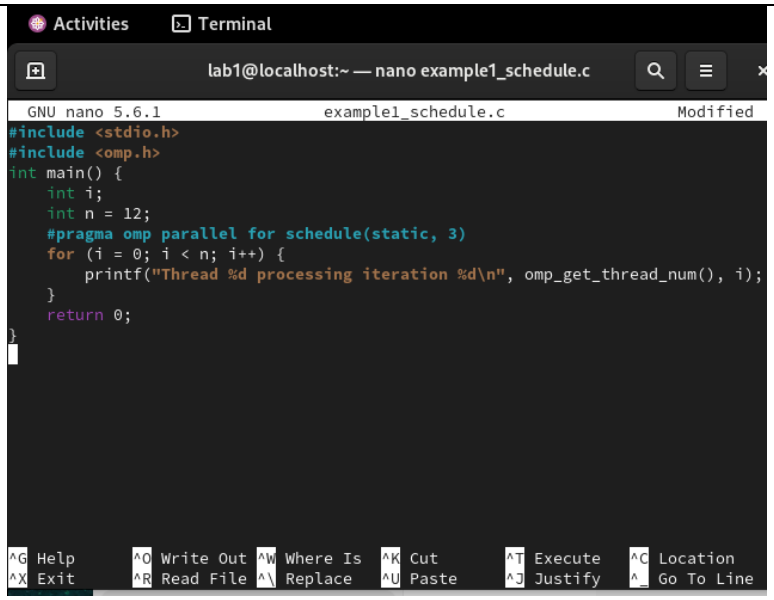

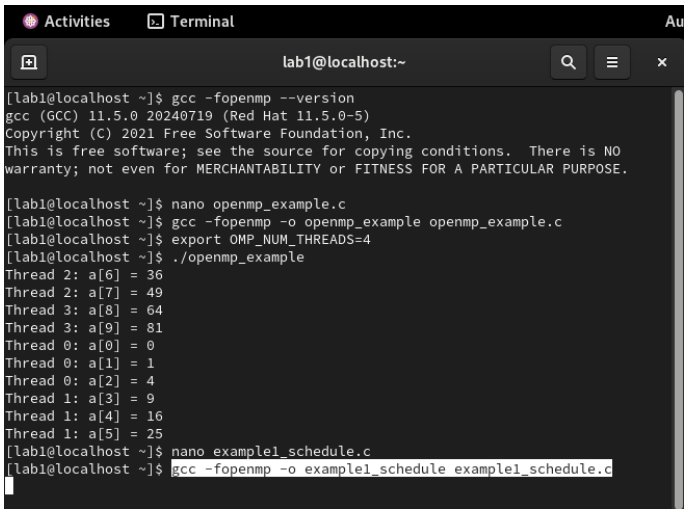

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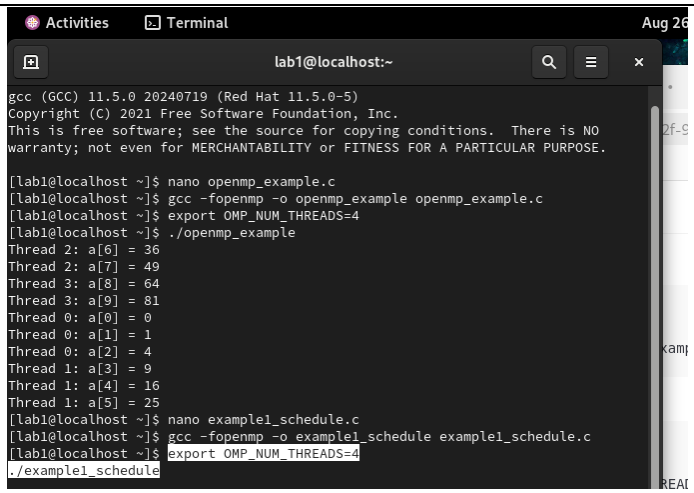

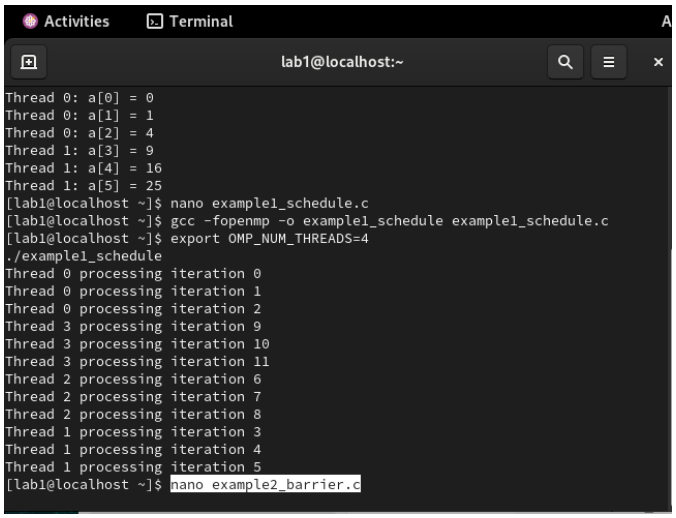

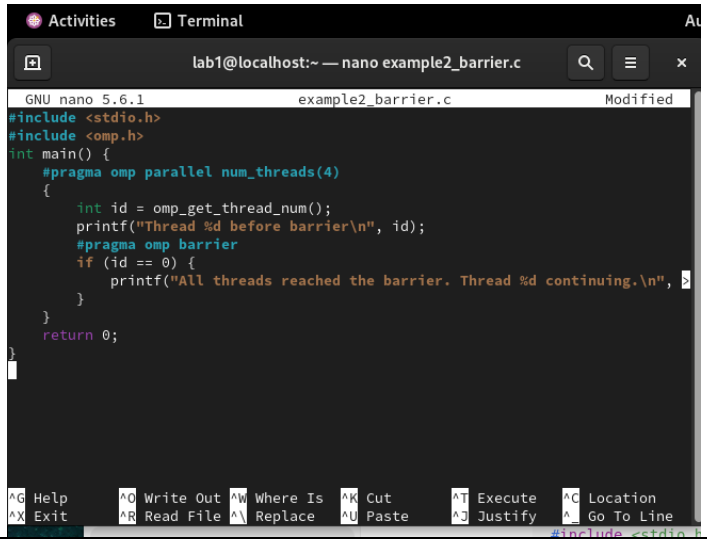

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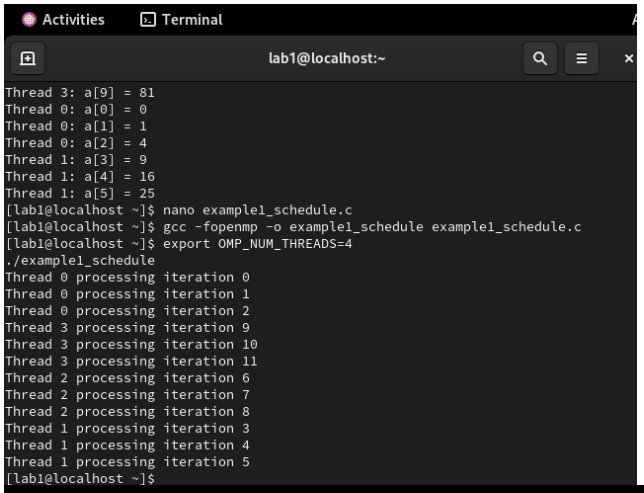

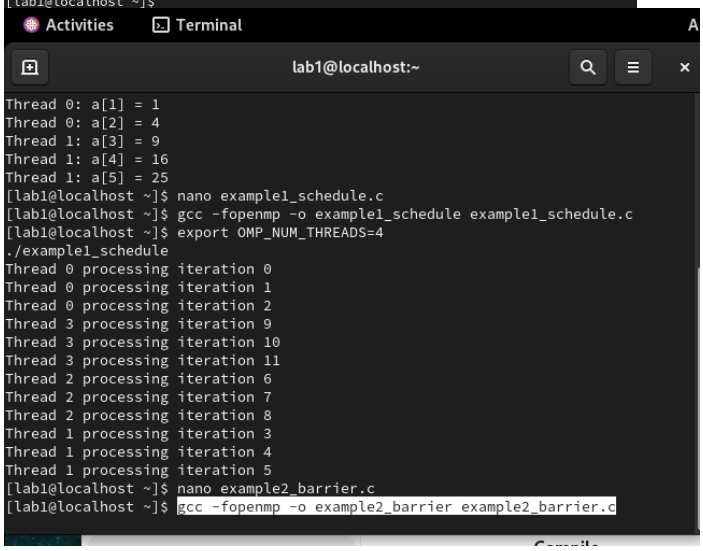

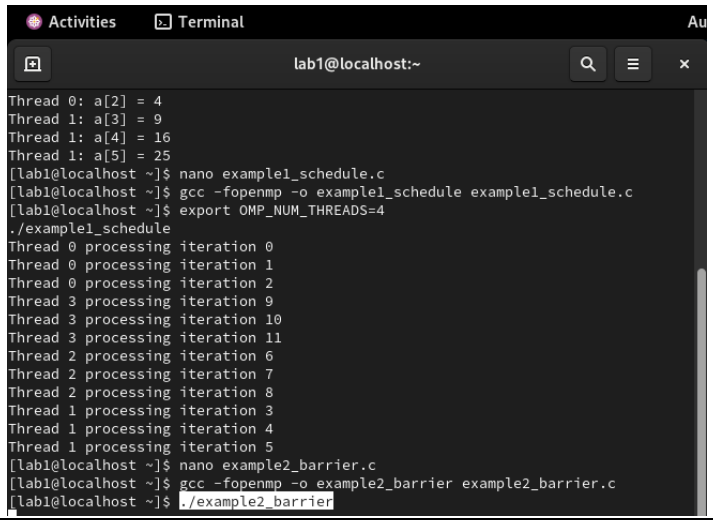

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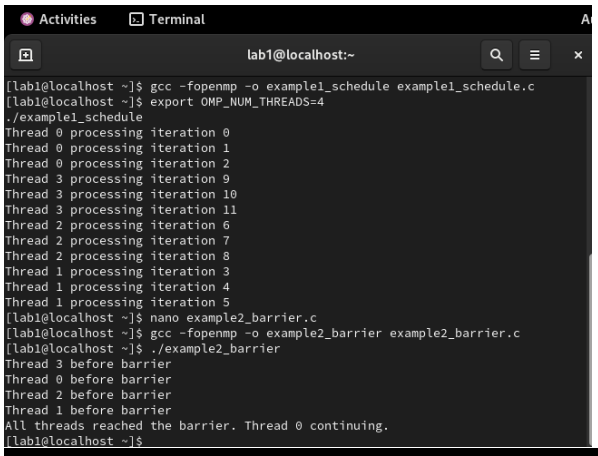

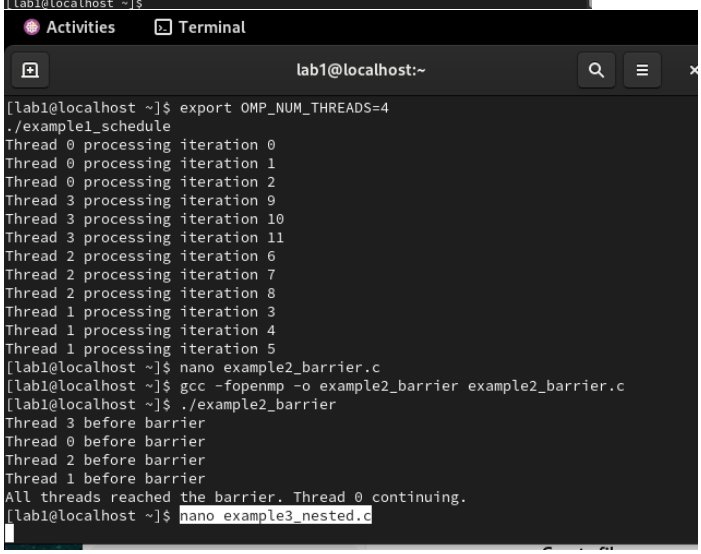

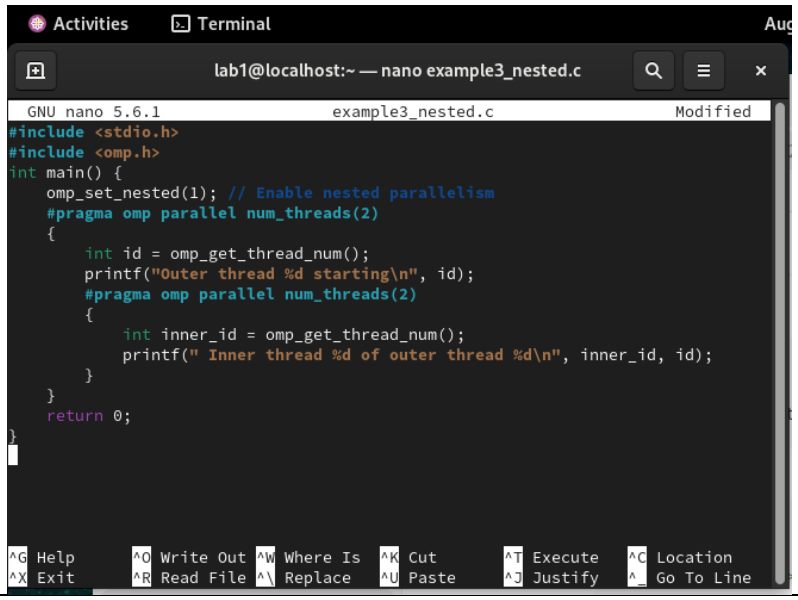

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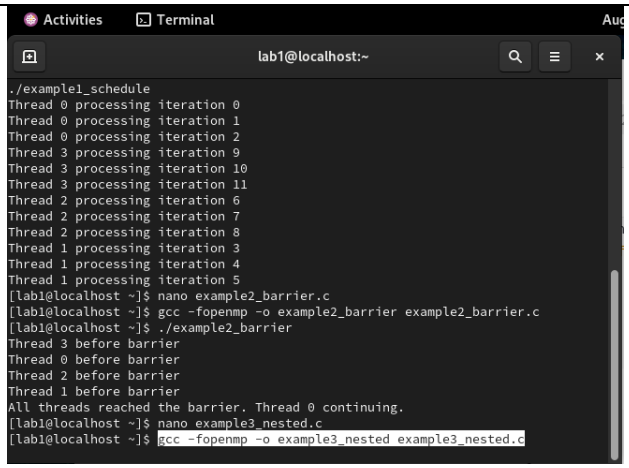

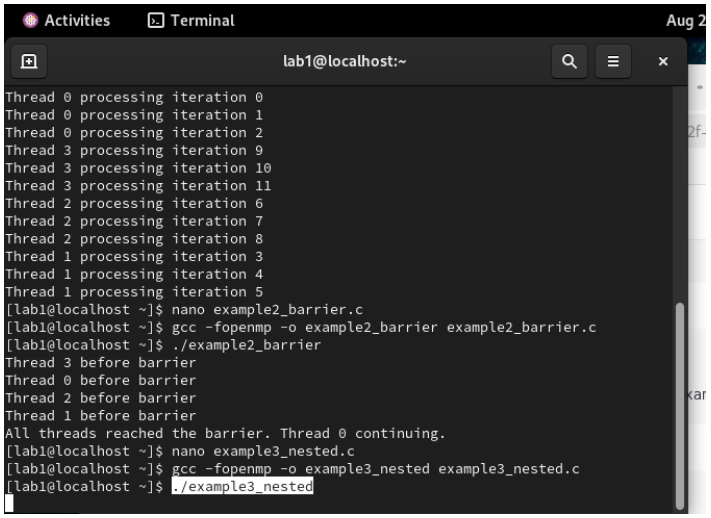

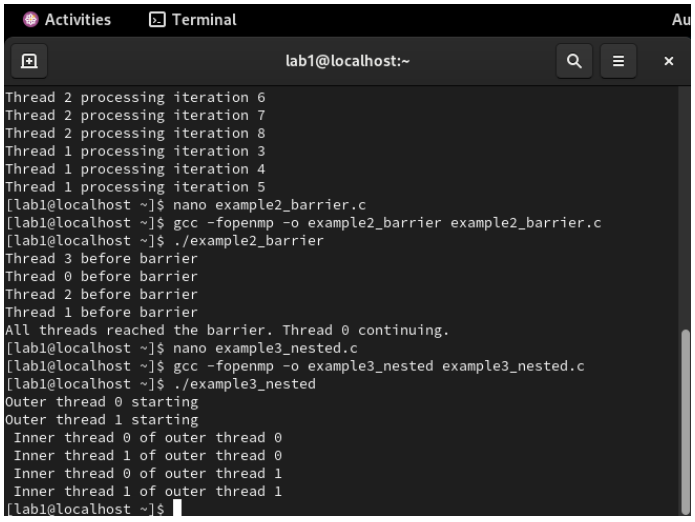

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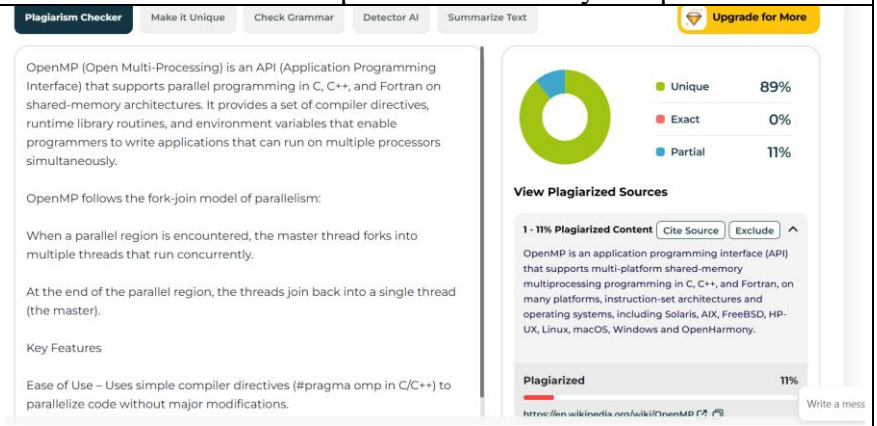
Output Analysis	The output demonstrates how OpenMP forks multiple threads to run the same block of code concurrently. The execution order may change, but the number of threads remains consistent with the environment variable or default system settings.
Link of student Github profile where lab assignment has been uploaded	
Conclusion	Introduction to OpenMP successfully completed.
Plag Report (Similarity index < 12%)	
Date	26/ 08 /25