King Saud University
College of Computer and Information Sciences
Department of Computer Science
CSC453 – Parallel Processing – Tutorial No 1 – Third Quarter 2022/23

Question 1

1. Give the definition of Parallel computing and Parallel Programming

   Parallel Computing: is a technique to accelerate computations in which many calculations are carried out simultaneously.

   Parallel Programming: consists of decomposing a programming problem into tasks, Deploy the tasks on multiple processors and run them simultaneously, Coordinating work and communications of those processors.

2. Enumerate and give a brief description of the main opportunities of parallelism.

   - **Instruction Level Parallelism**
     Hidden Parallelism in computer programs by compilers.

   - **Single computer level**
     Multi-core computers: Chip multi-processors Dual-core, Quad-core
     Multi-processor computers: Symmetric multi-processors Super-computers

   - **Multiple computers level**
     Clusters, Servers, Grid computing
     Collection of computers.
     Clusters: Fixed, built at compile time, don't change at run time.
     Grid: Not fixed, unknown at compile time, my change at run time.

3. Use an example to explain how the Instruction Level Parallelism works.

   We translate the instruction into a tree where the leaves are numbers, and the other nodes are operators. The parallelism consists of running nodes of the same level simultaneously, bottom up.

   (a+b) * (c+d) could be computed simultaneously.

   Separation of instructions and data. Instructions and memory references execute in parallel without interfering.

   Instruction Execution is pipelined: Processors initiate more than one instruction at a time.

4. Enumerate and give a brief description of the different types of parallel processing.

Task parallelism: Partition various tasks carried out solving the problem among the cores.

Data parallelism: Partition the data used in solving the problem among the cores. Each core carries out similar operations on it's part of the data.

5. What are the main differences between Distributed and Parallel Computing

	Distributed	Parallel
Objectives	• Increase Reliability • Increase availability	• Increase speed up • Decrease latency • Increase bandwidth • Increase throughput
Assumptions	Not reliable	Reliable
Interaction among processors	Infrequent	Frequent
Work load	• Heavy • Coarse grained	• Low overhead • Fine grained

Aspects of Parallel Computing:

1- Parallel Computers Architecture

2- Algorithms and applications:
- Reasoning about performance
- Designing parallel algorithms.

3- Parallel Programming:
- Paradigms: Message passing, shared memory, multi threading.
- Programming Models: SPMD, divide and conquer, task farming, data flow.
- Programming languages
- Frameworks
- Dedicated environments