COMP 8551 Advanced Games Programming Techniques

Assignment Project Exam Help

https://powcoder.com

Add WeChat powcoder

Borna Noureddin, Ph.D.

British Columbia Institute of Technology

Heterogenous computing

Overview

- Motivation
- Parallel software
  - Data-parallel
  - Task-parallel
- Heterogenous computing

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

Motivation

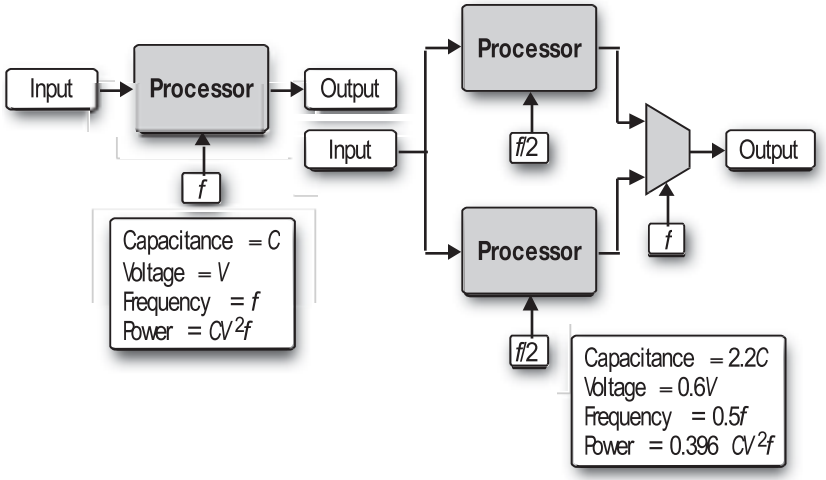
- Programming computers composed of a combination of CPUs, GPUs, and other processors
- Write single program that can run on wide range of systems
  - Cell phones
  - Laptops
  - Nodes in massive supercomputers
- High portability by *exposing* hardware

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

Motivation

- Raw performance used to drive innovation
- Focus now performance delivered per watt expended
- Many cores at lower frequencies more power-efficient
- Will continue to squeeze more transistors onto single die
- But now will compete on power efficiency instead of raw performance
- Microprocessors built from multiple low-power cores

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder



Concurrency/parallel software

- Parallelism = concurrency enabled by hardware
- Challenge for programmers:
  - find concurrency in problem
    - can be as simple as executing independent stream of operations for each pixel in image
    - can be incredibly complicated with multiple streams of operations that share information and must tightly orchestrate their execution
  - express concurrency in software
    - streams of operations that will execute concurrently must be defined
    - data they operate on associated with them
    - dependencies between them managed so that correct answer is produced when they run concurrently
  - run resulting program so that concurrency delivers desired performance

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

Parallel programming

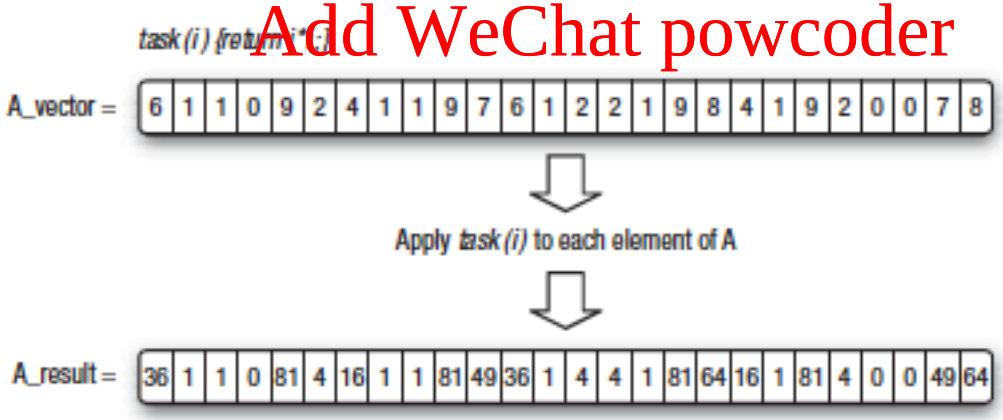
- This is the crux of the parallel programming problem
- Key to parallel programming: high-level abstraction or model to make parallel programming problem more manageable
- Task parallelism
  - E.g., problems organized around updates over points on grid
- Data parallelism
  - E.g., problems expressed as traversals over graphs

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

Data-parallel programming

- Programmers think of their problems in terms of collections of data elements that can be updated concurrently
- Parallelism expressed by concurrently applying the same stream of instructions (a task) to each data element
- Parallelism is in data

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder



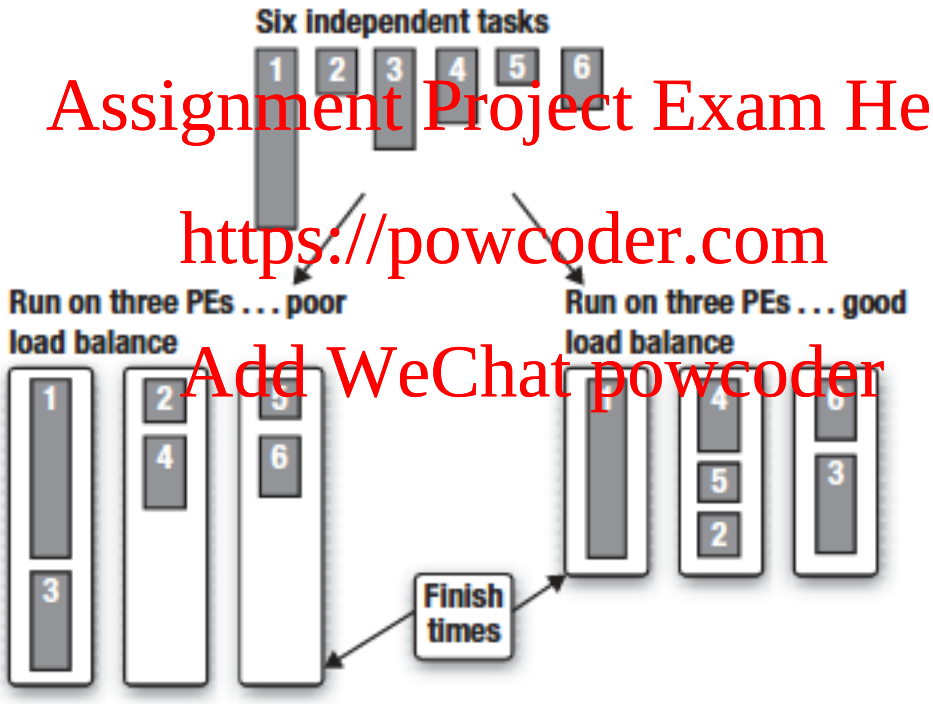
© Borna Noureddin

Task-parallel programming

- Directly define and manipulate concurrent tasks
- Problems decomposed into tasks that can run concurrently, which are then mapped onto processing elements (PEs) of a parallel computer for execution
- Easiest when tasks completely independent, but is also used with tasks that share data
- Tasks vary widely in computational demands, so distributing them so that they all finish at about the same time can be difficult: **load balancing**

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

Task-parallel programming

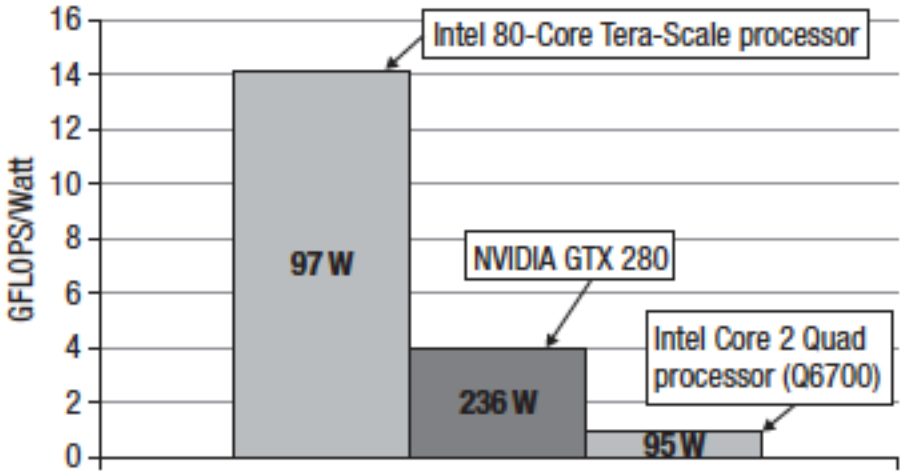


Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

Heterogenous computing

- General-purpose processor:
  - wide range of functional units to respond to any computational demand
- Processors specialized to a specific function:
  - fewer wasted transistors
  - include only those functional units required by their special function

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder



Heterogenous computing

- Regardless of programming model, next step = map program onto real hardware

Assignment Project Exam Help

- Here, heterogeneous computers present unique problems

https://powcoder.com

Add WeChat powcoder

- Computational elements in system may:
  - have different instruction sets
  - have different memory architectures
  - run at different speeds

© Borna Noureddin

Heterogenous computing

- Traditionally:
  - think of software as set of modules implementing distinct portions of problem
  - modules explicitly tied to components in heterogeneous platform
  - E.g., graphics software runs on GPU, other software runs on CPU
  - General-purpose GPU (GPGPU) programming broke this model
  - Algorithms outside of graphics were modified to fit onto GPU
- Hardware heterogeneity complicated
- Programmers depend on high-level abstractions that hide complexity of hardware
- Heterogeneous programming language exposes heterogeneity and is counter to the trend toward increasing abstraction

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

Heterogenous computing

Application for heterogeneous platform must:

1. Discover components that make up heterogeneous system
2. Probe characteristics of components so software can adapt to specific features of different hardware elements
3. Create blocks of instructions (kernels) that will run on platform
4. Set up manipulate memory objects involved in computation
5. Execute kernels in correct order and on correct components of system
6. Collect final results

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

Review

- Motivation
- Parallel software
  - Data-parallel
  - Task-parallel
- Heterogenous computing

Assignment Project Exam Help
https://powcoder.com
Add WeChat powcoder

© Borna Noureddin

Assignment Project Exam Help

END

https://powcoder.com

Add WeChat powcoder

© Borna Noureddin