

Engineering 8893 Concurrent Programming

Dennis Peters
 Memorial University
 dpeters@engr.mun.ca, 737-8929

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What is Concurrent Programming?

Concurrent Program: When two or more processes cooperate to achieve a common goal.

- Multiple threads of control
- Inter-process Communication
 - Shared variables
 - Message passing
- Synchronization
 - Mutual exclusion — processes must execute their *critical sections* one at a time.
 - Conditional synchronization — processes wait until a condition is true.

Note: Concurrent programming does not require multi-processor.

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2

Why Use Concurrent Programs?

- Faster processing
- More effective use of resources
- Easier to program (sometimes)
- Fault tolerance
- System is distributed

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3

What's different about it?

- Program steps from different processes may be inter-leaved or concurrent.
- Need to consider other processes.
- Usual proof rules don't apply.
- Testing is never sufficient.

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Course Outline

| Topic | Lecture hours |
|------------------------------|----------------------|
| Architectures & Applications | 2 |
| Processes & Synchronization | 3 |
| Locks & Barriers | 3 |
| Semaphores | 2 |
| Monitors | 3 |
| Message passing | 3 |
| RPC & Rendezvous | 2 |
| Interaction Patterns | 2 |
| Scientific Computing | 3 |
| Transaction processing | 2 |
| Model Checking | 3 |
| Real-time systems | 3 |