Exam topics for Concurrent Programming Languages.

Oleg Batrashev

May 24, 2012

These are the topics for the Concurrent Programming Languages course exam. The topics are covered during lectures and most are in the CTM book, except Erlang fault tolerance model and concurrency in other languages.

• For every topic there are several keywords or ideas that I relate to the topic. The more you know about the topic the better. Your experience and thoughts are welcome.

• I’ll divide 18 questions into 6 tickets with 3 questions each. Each question is worth 15 points, 50 max in total for one ticket.

• Exam type is oral. You have time to prepare, where you may write down notes or pictures to show me during the examination.

• If you omit something I consider important I’ll try to give hints.

• Short examples in any applicable language (even pseudocode) are welcome but no syntactic validity is necessary for the code, just to make sure you grasp the ideas.

Introduction

1. Definition(s) of parallel and concurrent, where and how parallelism is used.

2. Classifications of concurrency.

3. Problems with concurrency: race conditions, deadlocks, examples, source of the problems.

Declarative concurrency

4. Declarative programming: declarativeness, iterative and recursive computations, accumulators.

5. Purely functional (immutable) data structures: example structures, behavior with multiple threads, pros and cons.

6. Declarative concurrency: presence or lack of determinisms, presence of race conditions, exceptions.

7. Streams: demand-driven concurrency, problem with several readers/writers, problem with joining 2 streams.
Message-passing concurrency

8. Port concept, why we need it, lock-step execution of declarative model, equivalency with cells.
9. Port objects (agents), reasoning with agents, state diagrams.

Shared-state concurrency

11. Explicit state, programming with explicit state – limiting interleavings, equivalency with ports.
13. Confinments, active objects (actors), difference with (Oz) agents.

Concurrency elsewhere

15. Erlang core and agents, difference from Oz.
17. Software Transactional Memory (STM) in Haskell.