The final exam is cumulative, but with an emphasis on the concurrency paradigm.

1. There will be one question from the functional paradigm and one question from the declarative/logic paradigm. These questions will be taken from the exercise sets.

2. One question will give the code for Sestoft Example 90 and some three-digit input strings and will ask to predict the precise output of the computer run.

3. The following proof (among others) will be on the exam. It is part of the proof that Dekker's algorithm is starvation-free, which is in the slides. You will be given Dekker's algorithm.

   Here is Lemma 4.10
   (4.2) $turn = 1 \vee turn = 2$
   (4.3) $p3..5 \vee p8..10 \equiv wantp$
   (4.4) $q3..5 \vee q8..10 \equiv wantq$

   Here is Lemma 4.11, (L4.11): $\Box wantp \wedge \Box turn = 1 \Rightarrow \Diamond\Box\neg wantq$

   Here is Lemma A: $p2 \wedge \neg\Diamond p8 \Rightarrow p3, p4$ forever

   Assuming the above lemmas, prove Theorem 4.12 Dekker's algorithm is starvation free.

4. Know the specifications of the operations for semaphores and monitors (but not including those for Java), and the semaphore invariants (Theorem 6.1).