CS-E4110 Concurrent programming

Please note: To pass the course you need 300 total points and pass 4 rounds of the exercises. Contact the lecturer after the exam if you have not completed the exercises successfully.

The exam contains five questions. The maximum points for each question are listed in the beginning of the questions. Read the questions carefully. Give clear and compact answers. Remember to write the name of the course and your own personal information on each of your answer papers. No extra appliances are allowed in the exam.

1 (6p) Why the details of accessing variables are often important to know in concurrent programming? What are synchronized and volatile variables in Scala and how they are used in concurrent programming?

2 (10p) Answer *shortly* with clear definitions and descriptions. (Max. two points per subquestion.)

   a) What is a race condition?
   b) What is a data race?
   c) What is livelock?
   d) What is multitasking?
   e) What is Dekker's algorithm?

3 (6p) What are monitors, what do they consist of, how are they initialized, and how they are used? Describe the basic operations of Scala monitors.

4 (6p) Explain Scala (*i.e. Java/JVM*) memory model. What is the happens-before relation and how is it used to define the JVM memory model? What kind of behaviours are allowed by the JVM memory model that are not allowed by sequential consistency? How does the JVM memory model compare to the C/C++ memory model?

5 (6p) Write an essay (max 50 lines) on correctness of concurrent programs.