Center for Research on Embedded Systems (CERES)

Embedded Systems Programming

Assessment Guide

In this document, the type of questions that may be posed in the final examination of listed. In order to learn about these subjects, you need to study the handouts and TinyTimber documation and also go through your solutions to the practicals. Reading the book chapters is recommended, but not necessary. Likewise, reading Liu and Layland's paper and the notes on the proof of the schedulability theorem are not necessary.

Knowledge:

Know and compare the following concepts:

- Memory-mapped IO vs. separate bus IO,
- Shadowing and shadow variable,
- Busy waiting vs. interrupt-driven IO (and time-slicing),
- Manual vs. automatic interleaving,
- Synchronous vs. asynchronous call,
- Static vs. dynamic priorities,
- Rate Monotonic vs. Earliest Deadline First scheduling,
- Periodic task scheduling vs. deferrable servers
- Activity vs. notification
- Service vs. worker thread

Application

Be able to implement or analyze a piece of code using the following programming techniques:

- Bitwise operations using bytes and nibbles
- Synchronization using mutex
- Spawning, yielding and dispatching threads using setjmp and longjmp
- Synchronous and asynchronous calls using mutex and spawn,
- Interrupt handlers,
- Reactive objects, synchronous and asynchronous calls,
- Periodic tasks and deadlines using send,
- Multithreading in Java using Runnable,
- Interaction with UI in worker threads,
- Starting services from activities,
- Communicating using sockets, and
- Notifications and linking them to activities.

Use Rate Monotonic and Earliest Deadline First scheduling to determine the execution of a set of periodic tasks.

Determine the schedulability of a set of tasks using utilization-based schedulability analysis for both Rate Monotonic and Earliest Deadline First.

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Analysis

Know and explain the challenges regarding the following models of embedded systems programming, possibly by means of an example:

- Busy waiting
- Interrupt-Driven IO
- Interleaving by Hand
- Concurrency

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