Written Exam for Operating System Design

February 27th, 2017 (WiSe 2016/2017)
60 points total
120 minutes examination time.

Exercise 1 (9 points)

Multiple choice over all chapters, check true/false.

- Monolithic OS
- Microkernel speed
- SSD Wear-leveling
- Demand Paging
- Local page eviction
- Thrashing
- 3 others

Exercise 2 (6 points)

- Repeat all service and kernel layers of a microkernel OS (4 points)
- Describe the hourglass architechture in operating systems (2 points)

Exercise 3

- What is a TCB? Describe what is contained in a TCB.
- Given a diagram containing three boxes for thread states and four arrows for their transitions, name the thread states and the transitions between them (all boxes / arrows are contained in a box named "active").

Exercise 4

- Given four function graphs with time on the x-axis and value on the y-axis, which of them are soft real time, which are hard real time?
- What is processor affinity in scheduling? By what is it caused?

Exercise 5

- Achieve mutual exclusion between two tasks A and B on two threads 1 and 2 with signal and wait operations.
- Given four diagrams of interaction of two threads with signal and wait operations, describe whether the sender / receiver is synchronous / asynchronous.

Exercise 6

- Given the diagram structure of a two-stage hierarchical address translation, label all boxes / text elements and operators into the three circles.

Exercise 7

- Given a direct file organization system with extendible hashing, and a diagram of the current organization, insert a certain element, and state the new gmax value.

Exercise 8 (5 points)

- Which of the two described diagrams depicts programming I/O? What is the name of the other technique for I/O? (DMA -- 1 point)
- What is the most time-consuming part of HDD access? (1 point)
- Which HDD access strategies discriminate innermost and outermost tracks? (1 point)
- What is the shortest possible read time and write time of RAID 0, and RAID 1? (2 points)

Exercise 9 (4 points)

- You are given two identical threads of a server which does brightness adaption for the single frames of a video. Use signal and wait to make sure the order of the objects is preserved.
- What is the name of the parallelization technique?

Exercise 10 (3 points)

- calculate the number of objects in the waiting queue given the arrival rate and the mean response time (1 point).
- state the law on which you have calculated the number of objects in the waiting queue (2 points).