Karlsruhe Institute of Technology

Operating Systems 2016/17
Tutorial-Assignment 12

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Question 12.1: Memory Allocation Policies

Given a system with 4200 memory cells and the following allocation of blocks in main memory: 1000 blocks starting at 1000, 500 blocks starting at 2900, and 800 blocks starting at 3400.

a. A program allocates additional blocks of memory of lengths 500, 1200, and 200 (in that order) according to the *best fit* policy. Show the memory pattern of allocated blocks and remaining holes after each allocation. Consider the program to halt if a request cannot be fulfilled.

b. If the above does not succeed, try to create a sufficiently large hole by compacting allocated blocks towards address 0. Move allocated blocks in ascending order of their starting addresses and continue until the resulting hole is large enough.

Question 12.2: Buddy Allocator

a. How does memory allocation using the buddy allocator work?

b. Given a memory of size 2^k managed according to the buddy system. How many entries are there in the free list for a memory request size of 2^m maximally and minimally with $m < k$?

c. What type of fragmentation does the buddy system suffer from?

d. Can you imagine a way to reduce fragmentation when using a buddy system?

Question 12.3: Solid-State Drives

a. Why is rewriting data on a flash-based solid-state drive an order of magnitude slower than writing?

b. How do spare blocks help with this matter?

c. Describe how the `trim` command helps improving slow rewrites.

Question 12.4: Accessing Files and Directories

a. What is the difference between an absolute and a relative path name?

b. What are the basic methods for accessing a file?

c. In Linux and Windows, random access on files is implemented via a special system call that moves the “current position pointer” associated with a file to a given position in the file. What are the names of these system calls in Windows and Linux?

d. Discuss alternative random access implementations without such a system call.

e. What system calls do you need to list the files in a directory in Linux?