University of Athens - Department of Informatics and Telecommunications

Operating Systems (K22) / Winter Semester 2022-2023 / Assignment 1

The task is to develop a set of N+1 processes (1 parent, N children) that will behave as follows:

- The parent process, upon startup, receives a text file as an argument. A prerequisite is that the length of the file is relatively large (> 1000 lines). Additionally, an execution parameter of the parent process will be the degree of file partitioning (e.g., 100 means the file will be organized into segments of 100 lines each).

- The child processes, when started (created by the parent process), randomly select a line in the file, indicating the segment and the specific position, e.g., <7, 34> means 7th segment, 34th line within the segment. Such a command will trigger the retrieval of the file segment into memory and the delivery to the requesting process of the requested line.

- Once a segment has been retrieved and is in main memory, it can serve other requests that refer to the same segment (multiple readers) without mutual exclusion. When there is no further interest in the specific segment while pending requests exist for another, the necessary replacement takes place (e.g., segment 7 is replaced in memory by segment 4).

- Requests that cannot be served due to the absence of the requested segment in main memory remain pending until the specific segment is retrieved. For the retrieval of segments in main memory, a simple FIFO strategy is followed.

- Each child, upon completing a request, can proceed to submit the next one. There is a preference for the same segment as the previous request, without excluding the possibility of selecting a different segment. For instance, with a probability of 0.7, the new request will refer to the same segment, while with a probability of 0.3, a new segment is selected.

- The number of requests that each child must process will be provided as an external argument (e.g., 1000) to the parent process.

- After retrieving each line, the requesting process records in a log file (1 per child process) the submission time of the request, the response time, the request in the format <x, y> as described above, and the line itself.

- The parent process, responsible for the replacement of file segments in memory, also reports the entry and exit time of a segment from memory.

- The requests of the processes can be implemented with specific actions using a set of semaphores, while the movement of file segments to main memory is the responsibility of the parent process. The shared memory hosts the shared segment of the file.