Ain Shams University
Faculty of Engineering
Computer Engineering and Software Systems Program

CSE 335: Operating Systems – Fall 2022
CSE 223: Operating Systems – Fall 2022

T E R M - P R O J E C T R E Q U I R E M E N T S

This project is a group project, where each group contains 10 to 12 students. In this project, you will implement various algorithms used in operating systems that have been studied in class on MINIX 3 operating system. MINIX 3 is a free open-source operating system based on a tiny microkernel running in kernel mode with the rest of the operating system running as a number of isolated, protected, processes in user mode. It runs on x86 architecture and x86 virtual machines. MINIX is based on a small (about 12K lines of code) microkernel that runs in kernel mode. The rest of the operating system runs as a collection of server processes. These processes include the virtual file system, one or more actual file systems, the memory manager, the process manager, the device drivers … etc., each one running as a separate user-mode process. You can download MINIX 3 source code from https://www.minix3.org/. Meanwhile, you can use any other alternative to MINIX from the following list:

- OpenBSD
- Linux
- NetBSD
- Dragonfly BSD
- Qubes OS
- Haiku
- Redox
- FreeDOS
- skiftOS
- Tock
- Subgraph OS
- Barrelfish
- ToaruOS
- PowerNex
- Interim OS
- KolibriOS

The project required in this assessment consists of the following requirements:

Requirement 1

In this part of the assessment, you need to modify MINIX 3 to include the following scheduling algorithms:

- Round Robin
- Shortest Job First (SJF)
- Priority based
- Multi-Level Feedback Queue

The user should be allowed to edit a configuration file in the operating system to provide any required parameters or assumptions for these scheduling algorithms. Real processes must be executed and each algorithm must be tested by computing the average turnaround time and waiting time for each algorithm for a set of processes that start, execute, and end in specific times. A detailed comparative analysis and explaination of the results must be included in the report that will be deliveed by the end of the assessment.

Requirement 2

In this requirement, you need to implement hirarchical paging in MINIX 3, with all the needed parameters (page size, number of levels, address format … etc.) are user-defined via a configuration file. Additionally, FIFO and LRU page replacement algorithms should be implemented (configuration parameters of these algorithms should be stored in configuration file too). The performance parameters (e.g., number of page faults, number of empty frames … etc.) of the hirarchical paging as well

as the replacement algorithms should be collected as the the size of the pages and the number of levels are changed, with a complete analysis should be provided in the report in addition to the collected results.

Requirement 3

In this requirement, you need to find how MINIX 3 manages empty space, then you need to modify disk-space management code in MINIX 3 to use user-defined extents. Also, the disk allocation should be modified to provide the allocation in terms of the user-defined extents. The extent itself consists of a set of disk blocks where they are handled as a single unit. User should provide all needed configuration in a configuration file that is going to be read by MINIX 3 and adopted accordingly. The performcnce results of this method with respect to the number of blocks in the extent should be collected, explained, and presented in the report. You also need to find how MINIX 3 can create, read and write in files and Directories.

Requirement 4

You need to write a research report

1- Surveying the details of internal structure of the operating system that you select to work on and the other structures that is used in the other Operating systems.
2- A comparative study among the different algorithms you implemented in each component.

Deliverable

1. The MINIX 3 modified version after including all the requirements in it (in one archive file), also, a detailed readme.txt file should be included that shows how to install and configure each requirement so that it can be run in the modified version of MINIX 3.
2. A detailed report (in .docx format) that provides an overview of MINIX 3, the theoretical details of each of the implemented algorithm, the details of implementing each of the requirements in MINIX3 and how to use them, detailed test cases, the collected results, the analysis and justification of the results, the research report, the references adopted. You need to use technical writing skills in writing your report. The report will undergo plagiarism check.
3. The research report should be at least 8,000 words, follow the technical writing practices for writing research reports with proper formatting. Also, you need to provide the list of references you used while preparing the report (no Internet source can be used as a reference except for the official pages for the operating systems vendors for the operating systems) and cite the references inside the report.
4. A detailed presentation (in .pptx format) that presents each task, how it is implemented, the collected results and their explanation.