

ECE482 — Introduction to Operating Systems

Project 3

Manuel — GC (Fall 2025)

Goals of the project

- Kernel space implementation
- Scheduling algorithms
- Kernel parameters

1 Introduction

Two days... Already two days that you have submitted your work on the LemonDB system and still nothing, not even a word or an email. On this cold morning of November you slowly walk to your work under the light rain, lost in your thoughts. Why? Why is this Mr. Frown so mean? Your teammates had some very nice feedback, one of them has even been promoted. But on your side, nothing! As you feel overwhelmed by frustration, you mentally devise some strategies to approach Mr. Frown. You picture yourself confronting him and showing him how valuable you are to Lemonion Inc.. You anticipate every sentence he could pronounce and prepare a striking response.

Without even realising it you have arrived to your cubicle. Stimulated by this long introspection you decide to step into Mr. Frown's office. Arrived at his door you lift your hand and are ready to knock when you indistinctively hear Mr. Frown pronouncing your name! You slowly stop your movement and notice an upset tone in his voice. Pretending you need to lace your shoes you bow down and keep listening, while looking around to ensure nobody notices you.

After a few seconds it becomes clear that Mr. Frown is very upset with you. Not with your work, just with you. Although his words are sometimes unclear it is evident that he is furious that you worked well! He is saying that you are arrogant and want his position! Astonished by the absurdity of the situation and Mr. Frown's preposterous non-sense, you stand up and walk back to your desk. You slowly seat down and switch your computer on while trying to regain your composure. As the computer has completed the booting sequence you notice a new email from your friend Bob.

Date: Mon. 22 Nov. 2025, 09:34:24 +0800

From: bob@coolzone.it

To: n00b@lemonion.com

Subject: what's up?

Hi buddy,

Hope you're all good. What has Frown said about your work?

Here the company is so great, we had a giant party yesterday night so we almost all slept here! Jim, our boss (and friend) just announced that he wanted to test something new and their might be some openings. Would be great to work together, same as in college.

Jim is here today, feel free to pop in and have a chat, maybe you could join the new dev team... See you buddy!

Bob

Bob, Software Engineer at CoolZone IT solutions.

Knowing your time is counted at Lemonion Inc. you have nothing to loose, so you grab your bag and leave, hoping to catch this perfect boss, and never to return here.

As you enter in the building of CoolZone IT solutions, you are struck by the atmosphere: you see several groups of relaxed, laid back people. A bear feet man wearing a flowery swimming-suit passes in front of you, and starts talking with a girl at the front desk. After she has given him a large bag of golf clubs he leaves the building. You now walk to the desk and inquire about the CEO. At first it seems she cannot understand you, but all of a sudden she exclaims "You mean Jim? He is on the slide! He'll be down soon..." Feeling confused by her answer you gaze at her until she directs your attention to your right. Following her sign you walk a few steps and discover a long spiral slide coming down from the fifth floor and ending up in a giant ball pit where you recognise your friend Bob. He seems to be playing (discussing?) with a woman with long hair. However as they exit the pit you notice that the woman also has a long beard, meaning she is probably not a woman.

Feeling awkward and not knowing what to do, you choose not to move and wait for Bob and the other person to walk to you. As they are approaching he introduces Jim, his boss. Jim starts the conversation saying "Hey man, how are you keeping?" Before you can answer he carries on "Heard you were working with this – censored – Frown. We were together in college, he was a real – censored –." At least you have some common ground with Jim: you both hate Mr. Frown.

Jim speaks a lot, really a lot. Nothing seems to stop him. Although everything sounds confused in your mind you recollect that he offers you to work on a new project, but nothing is ready yet. So his conclusion is that someone needs to work on it, why not you? From what you understand he vaguely remembers that during his undergraduates studies he heard that lottery scheduling could almost be used for real time systems. He would like to use part of his new funding to test it and see if he could launch a new Linux based smartphone.

His idea would be to use the Linux kernel, but instead of implementing everything directly in the kernel, he would like to test the eBPF technology he has recently heard of. He sounds very excited by the idea of "injecting" code to the kernel while working in user-space! Ideally he expects you to implement lottery scheduling as well as Earliest Deadline First (EDF) and then compare their performance. He concludes the conversation with those few words: "You can start now, go in the ROMS, grab a laptop, and code. Organise yourself as you want, take as much holidays, free time, breaks as you want. Only requirements are that the project is completed early December and that you perfectly use our Gitea system. Cheers man!" On those words he runs to the pit, performs a somersault, and disappears among the balls.

Bob smiles and says "Welcome to CoolZone IT solutions! Follow me to the ROMS, our Rest, Organize and Manage Space." On your way to the ROMS Bob gives you a few more details regarding the project and how cool Jim is on everything but git! As this is much information you cannot fully understand everything but for sure you get that Jim wants you to perfectly handle your development workflow: you must use different branches, take advantage of labels and milestones to better organise your issues. Bob looks at you, and says "OK buddy. That's a lot to take, but don't worry, here there is no Frown, so relax and enjoy." While speaking he gets a small notebook from his jacket, removes a page and hands it to you as he continues "Those are my personal summary notes. For more details on our initial brainstorming session you can refer to the wiki notes. This should well summarize everything we have done so far. We count on you to complete the job! Make sure to quickly clarify your ideas and come up with a very clear Risk Assessment document and a detailed Roadmap, this very import..." He suddenly stops speaking, gives a circular look at the room, and moves back toward the door to grab a notebook on the

massive table at the center of the ROMS. He hands it to you and triumphantly announces "Here, it is! The company's directory. It seems Sylvia has already added you! So you can start working and catch your teammates as soon as you see them, some are not coming often so don't hesitate to ask around." On those words Bod greets you and leaves the room. As few seconds later he is back. He says "Sorry, forgot to explain about the notebook. I use different colors: blue for default tasks, orange for higher priority ones, and green for less pressing ones. So make sure to cover at least all the orange tasks!"¹ After winking his left eye to confirm his trust in you, he leave the ROMS for good.

As you have no idea on where to start you seat at the table, and face the door hoping someone will comes. After grabbing a laptop, you open it and notice a Blue screen of death! Clearly not the smooth start you expected, but as you are about to shut it down, you hear the loud laugh of Jim: "Don't do that! Just move the mouse..." As you follow his suggestion a regular Linux desktop immediately appears and Jim continues explaining that the blue screen of death screen-saver is his favorite joke with new employee, and that clearly no decent IT company would rely on Windows. Without any doubt Jim speaks too much, so you simply node as he keeps speaking and open a terminal to start working on this new exciting project!

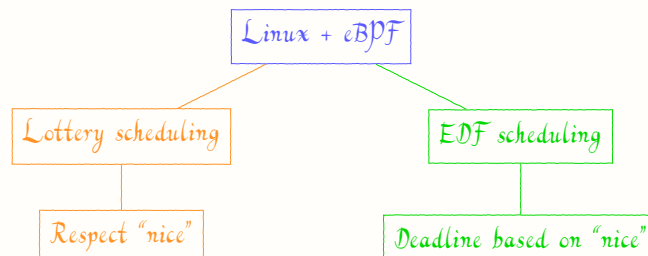
¹High priority orange tasks should be completed for ECE4820; lower green priority ones should be completed for ECE4821. Blue tasks are generic and should be completed together with green and orange ones.

A Bob's notebook

* Color code.

— common — high — low

* Tasks.



Important: Write test programs to demo Jim

* Requirements.

1/ Git usage: issue with basic description, a branch for each feature, use labels, setup and follow milestones, show the overall progress using a project, assign someone to each issue. Clear Roadmap!

2/ Demo to Jim and explain the whole work

3/ Implementation must be done through eBPF

* Difficulty.

Task	Level
Lottery scheduling	30
Respect "nice"	45
Solve simple investigation questions	45
Test program for lottery	20
EDF + deadline based on "nice"	40
Solve advanced investigation questions	20
Test prog for EDF	20

* Milestones.

0/ Lottery roadmap

1/ TBD

0/ EDF roadmap

1/ TBD

2/ or 3/ All completed!

B CoolZone IT solutions company directory

Teams

Chen Yaohui - Li Junhao - Qiu Guanhe

Jae-Heungpark - Rui Wang - Wentao He

Kantaphat Leelakunwet - Ruiqi Wang - Wu Yancheng - ZhangShengzhong

Li Leyao - Yi Yunhao - Zifei Xu

Wang Yixiang - Zhang Bohan - Zhu Hongrui

Chenyang Zhang - Jingyu Gu - Lekang Zhou - Yihan Zhang

DingLanqi - Weijie Yan - Yixin Wu - YuChenlu

Lin Ting - Suvonov Bunyod - Zhiyuan Ning - Zhiyuan Wang

Jiayin Chen - Jinlock Choi - Qizhen Sun - Tianzong Cheng