Task 1. Theory

a) Explain what the C programming language can be used for. 🔗

The C programming language is widely used for system programming and is especially suited for writing software that interacts closely with hardware and operating systems. Throughout the PG3401 course, we have learned that C provides low-level memory control, efficient performance, and access to system calls, which makes it ideal for the following use cases:

Operating systems: C is the language used to write most parts of Unix and Linux kernels.

Embedded systems: C is commonly used in microcontrollers and firmware where direct hardware access and efficiency are critical.

Drivers and hardware communication: C is used to develop device drivers due to its ability to access memory addresses and perform bit operations.

System tools and utilities: Programs such as compilers, shells, and command-line tools in Linux are typically written in C.

Network and multithreaded applications: C is used to implement network protocols and threaded programs, which we practiced using POSIX sockets and thread.

Security-critical software: C is often used in performance-critical security software like antivirus engines due to its control over memory and execution flow.

In short, C is used wherever low-level system access, performance, and deterministic behaviour are important.

b) Who is Dennis Ritchie and what is he known for in the field of Information Technology? 🔗

Dennis Ritchie was an American computer scientist best known for creating the C programming language and co-developing the Unix operating system together with Ken Thompson. His contributions are considered foundational to modern computing.

During the PG3401 course, we learned that C was developed in the early 1970s at Bell Labs. It was specifically created to rewrite the Unix operating system in a portable and efficient way. This innovation allowed Unix to run on different types of hardware, which was a revolutionary idea at the time.

Ritchie's work on C influenced many later programming languages, including C++, Java, and even modern system languages like Rust. His design allowed for low-level programming while still supporting structured programming practices.

In recognition of his contributions, Dennis Ritchie received several prestigious awards, including the Turing Award (1983) and the National Medal of Technology (1998).

In short, Dennis Ritchie is a central figure in the history of programming, and the tools he helped create (C and Unix) continue to form the backbone of modern operating systems and software development today.

c) List at least 5 different Linux "distros", explain briefly their background, if they have any specific purpose, and how they differ from each other. 🔗

1. **Debian**

- **Background**: Founded in 1993, one of the oldest and most stable Linux distributions.
- **Purpose**: General-purpose, with a strong focus on stability and free software.
- **Special features**: Used as the base for many other distros (like Ubuntu). It is also the required distro for the PG3401 exam.

2. **Ubuntu**

- Background: Based on Debian, launched in 2004 by Canonical Ltd.
- **Purpose**: Desktop- and user-friendly Linux distro.

- **Special features**: Large community, regular LTS (Long Term Support) releases.
- **Difference**: Includes more proprietary software by default and is easier for beginners.

3. **Arch Linux**

- **Background**: A lightweight and flexible distribution aimed at experienced users.
- **Purpose**: Allows users to build a system from the ground up.
- **Special features**: Rolling release model, minimal base install.
- **Difference**: No graphical installer; users install and configure everything manually, promoting full system understanding.

4. **Fedora**

- **Background**: Sponsored by Red Hat, used as a testing ground for Red Hat Enterprise Linux (RHEL).
- **Purpose**: Cutting-edge software and developer tools.
- **Special features**: Early adoption of new technologies like Wayland and PipeWire.
- **Difference**: Focuses on innovation over long-term support.

5. **Kali Linux**

- **Background**: Based on Debian, developed by Offensive Security.
- **Purpose**: Penetration testing, digital forensics, and ethical hacking.
- **Special features**: Comes preloaded with security tools like Nmap, Wireshark, Metasploit.
- **Difference**: Not meant for general-purpose use, but highly specialized for cybersecurity professionals.