# *Portfolio*

# *Lionelli Maroun*

● All project descriptions featured in my portfolio are accompanied by their corresponding code, available for exploration on my GitHub repository https://github.com/lmaroun?tab=repositories

## *Education*

▪ Completion of Introduction to Object-Oriented Programming (with Python) course.
▪ Completion of Computer Organization (with Machine Learning Verilog HDL) course.
▪ Completion of Objects and Data Abstraction (with Java) course.
▪ Completion of Algorithms and Data Structures (with Java) course.
▪ Completion of Operating Systems (with C) course.
▪ Completion of Data Base Management System (with SQL) course.
▪ Completion of Parallel Programming for Multicore and Cluster Systems (CUDA, OpenMP, MPI) course.
▪ Completion of Mobile Development (Ionic, React Native, Flutter, Xamarin) course.
▪ Completion of Game Programming (with C#) course.
▪ Completion of Software Engineering course.
▪ Completion of Computer Networks course.
▪ Completion of Network Security course.
▪ Completion of Machine Learning course.
▪ Completion of Web Programming (with PHP and JS) course.
▪ Basic knowledge of C++ Language.

## *Labs*

**Object-Oriented Programming Language Lab**
*Using PYTHON:*
● Explored Objects and Types, Operators, Expressions, Variables, and Assignments.
● Worked extensively with Strings, Input/Output, Modules.
● Emphasized Selection and Repetition.
● Specialized in Testing Primality algorithms.
● Manipulated Lists and Strings for various applications.
● Integrated Functions for complex operations.
● Utilized Lists, Tuples, Strings, Functions, Exceptions, and Assertions for comprehensive problem-solving.
● Applied plotting techniques within this context.

*Using JAVA:*
● Explored Object-Oriented Concepts:
    - Covered Classes and Objects fundamentals.
    - Explored Encapsulation for data protection.
    - Studied Composition and Inheritance for building complex structures.
    - Discussed Abstract classes and Interfaces for design flexibility.
    - Implemented Polymorphism through inheritance and interfaces.
● Addressed Exception Handling strategies within OOP.
● Covered File Management techniques.
● Worked with various data structures:
    - Utilized Array Lists, Linked Lists, Stacks, and Queues.
    - Explored Recursion for problem-solving.
    - Studied Trees: Binary Trees and Tree Traversals (in-order, pre-order, post-order).
    - Analyzed Binary Search Trees for efficient data organization.

**Computer Organization Lab**
- Developed a microprocessor by designing a circuit using the Quartus Prime application and developed a code to function using VERILOG HDL.
- Learned multiple universal gates involved in the design phase and simulation phase [(Waveforms) using Model Sim application] for microprocessors as well as Compile data into reports.

**Algorithms and Data Structures Lab**
- Mathematical foundations for algorithmic analysis.
- Reviewed classical sorting and searching algorithms (Bubble/Insertion/Selection sort, sequential and binary search) and Binary Search Trees.
- Applied Divide and Conquer to Merge Sort, Heap Sort, Quick Sort, and linear time sorting (e.g., Radix Sort), along with solving recurrences.
- Explored Graphs and their properties, traversal algorithms, and introduced NP-complete problems.
- Utilized recursive backtracking for decision, search, optimization, and enumeration problems.
- Covered Dynamic Programming and Greedy Algorithms (including activity selection, frog jumping, and Prim's MST algorithm).
- Studied Shortest Path problems and algorithms (Dijkstra, Bellman-Ford, Floyd Warshall).
- Analyzed the comparison between Dynamic Programming and Greedy methods through the Knapsack problem, along with Network Flow and Disjoint sets applications.

**Operating System Lab**
- Conducted hands-on exercises on Computer Systems and OS fundamentals.
- Practiced C Programming in a system-level context.
- Applied Linux Shell commands and functionalities in practical scenarios.
- Implemented and managed Processes within OS environments.
- Explored Multithreading through practical exercises for concurrent operations.
- Evaluated CPU Scheduling algorithms through practical lab sessions.
- Demonstrated Concurrency and Synchronization mechanisms in lab projects.
- Investigated Deadlocks and practiced resolution techniques.
- Engaged in practical sessions on Memory Management within OS.
- Simulated Virtual Memory concepts and their application.
- Explored File Systems Management through lab-based experiments and projects.

**Computer Networks Lab**
- Explored circuit-switched and packet-switching networks, understanding throughput and user capacity.
- Analyzed traceroute tool to diagnose network routes and round-trip delays.
- Evaluated network efficiency and congestion probability based on user activity levels.
- Applied theoretical concepts to troubleshoot and optimize networks.
- Utilized Wireshark for in-depth analysis of HTTP protocol interactions.
- Examined HTTP GET/response interactions, conditional GET/response, and retrieved long documents.
- Analyzed HTML documents with embedded objects and captured packet traffic for various scenarios.
- Conducted detailed packet inspection, extracting information for analytical assessments.

## *Projects*

**Database Management System**
- Developed a database of a gas company by designing an ER diagram using MS Visio application and constructed it with multiple SQL code using (Oracle Express).
- Learned the phases involved in designing a database for a company [Entity types, Relationships, Mapping, Tables, Normalization, …] as well as compile data into reports.

**Software Engineering**
- Developed a Flutter-based mobile app for a medical center, catering to both iOS and Android platforms.

- Collaborated with a team of software engineers to design, develop, and deploy the mobile app, ensuring adherence to best practices and industry standards.
- Conducted thorough requirements gathering and analysis to understand the needs of the medical center and its patients, translating them into technical specifications.
- Designed and implemented an intuitive user interface (UI) and engaging user experience (UX), prioritizing ease of use and accessibility for patients and medical staff.
- Integrated various features into the app, including appointment scheduling, patient records management, medication reminders, and telemedicine functionality.
- Conducted comprehensive testing, including unit testing, integration testing, and user acceptance testing, to ensure app functionality, performance, and quality.

**Mobile Development**
- Developed a Flutter-based mobile application for a Medical Center.
- Implemented user authentication and authorization for doctors and patients, ensuring secure access to the app. Designed and built intuitive user interfaces for various app screens, including login, home, appointment scheduling, pharmacy, and lab tests.
- Enabled patients to schedule appointments with doctors, request pharmaceutical drugs, and book medical tests.
- Provided doctors with features to prescribe drugs, manage their schedules, and modify patient medical records.
- Implemented notification settings for timely updates and reminders.
- Incorporated account management functionalities for users to edit and update their personal information.

**Game Programming**
- Developed a 2D tile-hopping game using Unity game engine.
- Implemented gameplay mechanics where players control a bunny character to hop vertically on a series of tiles.
- Created visually appealing cartoon graphics and charming animations to enhance the gaming experience.
- Designed tile variations, including double-hop tiles and breakable tiles, to add challenge and strategic decision-making. Implemented a scoring system to track players' progress.

**Parallel Programming**
- Developed parallel implementations of edge detection algorithms, including Sobel, median, and Gaussian filters, to enhance image processing efficiency.
- Utilized OpenMP, MPI, and CUDA frameworks for parallelization across diverse computing platforms.
- Implemented data partitioning strategies, such as scatter and gather (MPI), loop-level parallelism (OpenMP), and kernel launches (CUDA), for effective workload distribution.
- Optimized memory access patterns and leveraged shared memory (CUDA) to enhance data locality, reducing communication overhead.
- Conducted performance analysis, measuring speedup and scalability against sequential implementations, demonstrating significant performance improvements.
- Engaged in code optimization and tuning, adjusting configurations (CUDA), optimizing MPI communication patterns, and exploiting CPU threading (OpenMP) to further enhance algorithm efficiency across various parallel computing architectures.

**Computer Networks**
- Designed and implemented a client-server application for a banking system.
- Developed a Python-based client script interacting with the server via GUIs using Tkinter.
- Established socket connections between clients and the server for user actions (signup, login, deposit, withdraw).
- Managed user data through a text file database, enabling user authentication and signup functionality.
- Enabled broadcast messaging among connected clients via the server.
- Configured the server to handle up to 10 concurrent client connections.
- Implemented user actions such as deposit and withdrawal with error handling for insufficient balance.

- Demonstrated a simplistic yet functional architecture of a client-server application.
  Showcased continuous server operation and simultaneous client management.

**Web Programming**

- Developed a Hotel Management System website featuring pages such as Home, Admin, Admin Login Dashboard, Rooms, Reservations, Services, Contacts, and Index using HTML, CSS, JavaScript, and PHP.
- Implemented JavaScript to improve user interaction and responsiveness, providing a dynamic and engaging user experience on the website.
- Utilized PHP for server-side scripting, enabling efficient communication between the website and server, including database interactions and data processing.
- Designed and managed a relational database using PHPMyAdmin, ensuring secure and efficient storage of hotel-related data.
- Applied CSS for styling, enhancing the visual appeal, and creating a user-friendly interface for the Hotel Management System website.
- Engineered specific functionalities, such as room reservation, booking management, service requests, and contact forms, to streamline communication and enhance the user experience within the hotel system.

**Machine Learning**

- Analyzed historical flight data to forecast future flight costs.
- Explored crucial flight details such as departure/arrival locations, dates, airlines, and price-influencing factors.
- Implemented models/algorithms for accurate flight price prediction benefiting travelers and travel agencies in decision-making.
- Used libraries like pandas, seaborn, numpy, matplotlib.pyplot, datetime, sklearn.model_selection, sklearn.ensemble, pickle for data handling, visualization, and modeling.
- Conducted initial data exploration, preprocessing, and consistency checks including data replacement, extraction, duration handling, and categorical feature conversion.
- Visualized relationships between airlines, source/destination locations, and flight prices using boxen plots and one-hot encoding techniques.
- Created feature-target matrices, visualized feature importance, handled missing values, and performed randomized search for optimal model hyperparameters.
- Implemented and evaluated the Random Forest Regressor model for flight price prediction.
- Assessed model performance via visualizations of price differences, scatter plots for actual vs. predicted prices, and calculated R-squared score.
- Saved the trained Random Forest Regressor model for future use.
- Summarized the project's significance in predicting flight prices based on historical data and relevant features, highlighting potential benefits for decision-making and cost optimization in the aviation industry.