Computer Science 1 - Scope and Sequence

Course Description

This course is a dynamic and immersive introduction to the foundational principles that drive modern computing. This course equips students with essential problem-solving skills, programming techniques, and a deep understanding of how computers process and exchange information. Beginning with command-line interactions in a Linux environment, students will develop a strong technical foundation before progressing into web technologies, database management, and API integration.

As they advance, students will explore the fundamentals of networking, gain insights into machine learning, and experiment with game development, bridging the gap between theory and real-world applications. The curriculum seamlessly blends hands-on programming challenges with conceptual learning, encouraging students to think critically, analyze data, and design efficient solutions. By the end of the course, students will have a solid grasp of core computing concepts, preparing them for more advanced studies and future opportunities in the field of technology.

Module 1: Linux Command Line and File System Management

Key Topics

- Linux server access and security considerations
- File and directory navigation (pwd, ls, cd, mkdir, rmdir)
- File manipulation (touch, mv, rm)
- Using command-line text editors (Vim)
- Command history and keyboard shortcuts
- Linux permissions (chmod, chown)
- Input/output redirection (>, >>, |, /dev/null)

Skills Developed

- Navigating and managing files in a Linux environment
- Understanding command-line syntax and flags
- Configuring personal settings (.vimrc, .bash_profile)
- Handling system permissions and security concerns

Assignments/Projects

- Creating and managing files using the command line
- Writing and executing shell commands
- Exploring Linux system hierarchy and command history

Module 2: Web Development Foundations

Key Topics

- HTML Forms: Structure and input elements
- Form styling with CSS
- Client-side validation techniques
- Web form submission with PHP (GET vs. POST)
- Introduction to server-side processing

Skills Developed

- Structuring and styling web forms
- Implementing basic client-side validation
- Understanding form submission processes
- Exploring server-side handling of user inputs

Assignments/Projects

- Designing a structured and styled web form
- Experimenting with form validation techniques
- Implementing a basic form processing system in PHP

Module 3: Introduction to Databases and SQL

Key Topics

- Database concepts and relational models
- SQL commands (SELECT, INSERT, UPDATE, DELETE)
- Connecting PHP to MySQL

- Querying and manipulating structured data
- Data validation and security best practices

Skills Developed

- Understanding relational databases
- Writing SQL queries to interact with data
- Structuring data retrieval for web applications
- Implementing security measures for database interactions

Assignments/Projects

- Creating a guestbook system with SQL and PHP
- Writing SQL queries for CRUD operations
- Connecting a database to a web application

Module 4: Networking Fundamentals

Key Topics

- Local Area Networks (LAN) vs. Wide Area Networks (WAN)
- Internet architecture and IP addressing
- Network devices (routers, switches, DHCP servers)
- Private vs. public IPs and subnetting
- NAT (Network Address Translation)
- Configuring DNS and HTTP servers

Skills Developed

- Understanding network components and protocols
- Configuring network services
- Diagnosing network issues (ping, traceroute)
- Implementing basic web hosting concepts

Assignments/Projects

- Building a simulated network with different hosts and routers
- Configuring DNS for a web server
- Implementing NAT for a home network simulation

Module 5: Introduction to APIs and Data Handling

Key Topics

- API concepts and endpoints
- HTTP requests (GET, POST)
- Fetching and displaying data dynamically
- JSON data structures
- API integration with web applications

Skills Developed

- Understanding how APIs work
- Fetching and processing external data
- Parsing and displaying structured JSON data
- Implementing API calls in JavaScript

Assignments/Projects

- Fetching and displaying pixel art data from an API
- Implementing dynamic pagination for API results
- Integrating API comments into a web application

Module 6: Data Science and Machine Learning Fundamentals

Key Topics

- Data acquisition, cleaning, and formatting
- Command-line data manipulation (grep, awk, curl)
- Introduction to data visualization (Chart.js)
- Machine learning models (TensorFlow)
- Text classification and recommendation systems

Skills Developed

- Working with structured and unstructured data
- Visualizing trends using JavaScript charting libraries
- Implementing machine learning models in the browser
- Understanding matrices and linear algebra applications

Assignments/Projects

- Parsing and analyzing text-based datasets
- Creating interactive data visualizations

- Developing a simple movie recommendation system using machine learning

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Module 7: Game Development with JavaScript and WebSockets

Key Topics

- Game design principles
- Real-time interaction with WebSockets
- Client-server communication for multiplayer games
- Game physics (collision detection, movement)
- 2D to 3D game transition (p5.js to A-Frame)

Skills Developed

- Developing multiplayer game logic
- Implementing real-time server updates
- Designing interactive game elements
- Understanding game physics and network latency

Assignments/Projects

- Implementing a 2D multiplayer game using WebSockets
- Transitioning to a 3D multiplayer game with A-Frame
- Adding scoring and player customization

Module 8: Capstone Project

Key Topics

- Integrating multiple concepts into a single project
- Debugging and optimizing applications
- Presenting and documenting a final project

Skills Developed

- Applying knowledge from various modules
- Structuring a complete, interactive application
- Enhancing user experience and usability

Assignments/Projects

- Designing and developing a final capstone project
- Presenting the project and reflecting on learning outcomes

*__Disclaimer:__ The course structure and content outlined in this scope and sequence are subject to change. MYTEK LAB reserves the right to adjust the order, pacing, and topics covered to best meet the needs of students and ensure an optimal learning experience.