Scope of Exam (Written)

- Exam Preparation Guide
- Comprehensive Overview of OS, C Programming, Networking, and Algorithms

Agenda

- Topics Covered:
- 1. Operating System Concepts
- 2. Basic C Programming
- 3. Networking Basics
- 4. Advanced OS Topics
- 5. Advanced C Programming
- 6. Algorithms

What is an OS?

- An OS is system software that acts as a bridge between hardware and user applications.
- Provides an environment for executing programs.
- Examples:
- - Windows: Popular desktop OS.
- - Linux: Open-source, used in servers.
- - macOS: Apple’s proprietary OS.

Functions of an OS

- Process Management:
- - Manages process creation, execution, and termination.
- - Allocates CPU time effectively.

- Memory Management:
- - Allocates and deallocates memory.
- - Prevents memory leaks and fragmentation.

- File Systems:
- - Manages data storage and retrieval.
- - Organizes data in directories.

Types of OS

- Batch OS:
- - Processes jobs in batches without user interaction.

- Multitasking OS:
- - Allows multiple tasks to run simultaneously.

- Real-Time OS:
- - Processes tasks with strict timing constraints, e.g., medical systems.

Key OS Components

- Kernel:
- - Core of the OS; handles memory, processes, and device communication.

- Shell:
- - Interface between the user and the kernel; accepts commands.

- User Applications:
- - Programs run by users, dependent on the OS services.

Process vs Thread

- Process:
- - Independent execution with its memory space.

- Thread:
- - Lightweight, shares memory within a process.
- - Faster than processes.

Introduction to C

- Overview:
- - Developed by Dennis Ritchie in 1972 at Bell Labs.
- - Portable and efficient; forms the basis of many modern languages.

- Use Cases:
- - System programming, embedded systems, and general applications.

Data Types and Variables

- Data Types:
- - Primitive: int, float, char.
- - Derived: Arrays, pointers.

- Variables:
- - Used to store data in memory.
- - Must be declared before use.

Control Structures

- Conditional Statements:
- - if-else: Decision-making based on conditions.
- - switch: Handles multiple conditions.

- Loops:
- - for: Iterates a fixed number of times.
- - while: Repeats while a condition is true.
- - do-while: Executes at least once before condition check.

What is Networking?

- Definition:
- - Communication between devices over a shared medium.

- Purpose:
- - Data sharing, resource sharing, and connectivity.

- Types of Networks:
- - LAN: Small geographical area (e.g., home).
- - WAN: Large area (e.g., the internet).
- - MAN: City-wide coverage.

OSI Model Overview

- Layers:
- 1. Physical: Hardware connections.
- 2. Data Link: Error detection/correction.
- 3. Network: Routing data (IP).
- 4. Transport: Reliable delivery (TCP/UDP).
- 5. Session: Establishing/maintaining sessions.
- 6. Presentation: Data translation (e.g., encryption).
- 7. Application: User interaction (e.g., browsers).

Common Protocols

- HTTP/HTTPS:
- - Web communication (secured in HTTPS).

- FTP:
- - File transfer between systems.

- DNS:
- - Translates domain names to IP addresses.

- TCP/IP:
- - Reliable communication for network devices.

Network Security

- Threats:
- - Malware, phishing, unauthorized access.

- Solutions:
- - Firewalls: Monitor incoming/outgoing traffic.
- - Encryption: Secure data transmission.
- - VPNs: Private connections over public networks.

Virtual Memory

- Concept:
- - Simulates extra memory using disk space.

- Benefits:
- - Supports large applications.
- - Prevents insufficient RAM issues.

- Techniques:
- - Paging: Fixed-sized memory blocks.
- - Segmentation: Logical divisions.

Deadlocks

- Definition:
- - Processes stuck waiting for resources.

- Conditions for Deadlock:
- 1. Mutual Exclusion: Exclusive resource use.
- 2. Hold and Wait: Holding one resource, waiting for others.
- 3. No Preemption: Resources cannot be forcibly taken.
- 4. Circular Wait: Process chain dependency.

Scheduling Algorithms

- First-Come, First-Served (FCFS):
- - Simple but non-preemptive.

- Round Robin (RR):
- - Time-sliced execution.

- Priority Scheduling:
- - Based on task priority.

Device Management

- Role:
- - Ensures optimal usage of hardware resources.

- Examples:
- - I/O Devices: Printers, keyboards.
- - Storage Devices: Hard drives, SSDs.

Pointers in C

- Definition:
- - Variables storing memory addresses.

- Applications:
- - Dynamic memory allocation.
- - Arrays and strings.

File Handling in C

- Importance:
- - Managing data in files for storage and retrieval.

- Key Functions:
- - fopen(): Opens files.
- - fclose(): Closes files.
- - fprintf(): Writes data to files.

Structures and Unions

- Structures:
- - Group different data types under one name.

- Unions:
- - Share memory among members to save space.

Dynamic Memory Allocation

- Concept:
- - Allocating memory during runtime.

- Functions:
- - malloc(): Allocates memory.
- - calloc(): Allocates and initializes memory.
- - free(): Frees allocated memory.

What are Algorithms?

- Definition:
- - Step-by-step solutions to problems.

- Characteristics:
- - Clear and unambiguous.
- - Well-defined input/output.

Sorting Algorithms

- Bubble Sort:
- - Repeated swapping of adjacent elements.

- Quick Sort:
- - Divides array into smaller subarrays for sorting.

- Merge Sort:
- - Divides and merges sorted subarrays.

Searching Algorithms

- Linear Search:
- - Checks every element; time-consuming.

- Binary Search:
- - Efficient for sorted data; divides search range.

Complexity Analysis

- Big-O Notation:
- - Describes algorithm efficiency.
- - O(1): Constant time.
- - O(n): Linear time.
- - O(log n): Logarithmic time.

Graph Algorithms

- Depth-First Search (DFS):
- - Explores as deep as possible before backtracking.

- Breadth-First Search (BFS):
- - Explores all neighbors before moving to the next level.

Preparation Tips

- Study:
- - Focus on core concepts and problem-solving techniques.

- Practice:
- - Solve coding challenges.

- Test:
- - Take mock exams to identify weaknesses.

Q&A

- Open discussion.
- Clarify doubts about any topics.

Thank You

- Best wishes for your exam!