Teaching Guidelines for

Concepts of Programming & Operating System

PG-DAC September 2022

Concepts of Programming

Text Book:

- Core and Advanced Java Black Book / Dreamtech Press

References:

- Java The Complete Reference by Herbert Schildt / McGraw Hill
- Core Java : Fundamentals - Volume 1 Gary Cornell, Cay S. Horstmann/ Pearson
- Programming in Java by Sachin Malhotra, Saurabh Choudhary / Oxford University Press

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Sessions 1 & 2:
Lecture:
Getting Started

- Setup development environment (JRE, JDK, eclipse)
- Writing your first Java program

Variables & Methods

- About main () method
- Java Data Types, Primitives and Binary Literals
- Data type compatibility and casting of primitive data types
- Static variables and methods
- Accessing static variables and methods of different class
- Final variables

Operators

- Arithmetic Operator
- Relational Operator
- Logical Operator
- Unary Operator
- Ternary Operator
- Assignment Operator

Lab:

Session 3: Conditional and Looping Statements Lecture:

- If, else if, switch
- break & continue keyword
- for loop
- while loop
- do while loop
- Recursion

Session 4: Objects

Lecture:

- Reference variables and methods
- Constructors (Default constructor, parameterised constructor)
- Static method v/s instance method
- Reference variable as instance member of the class String class

Session 5 & 6: Arrays

Lecture:

- Initializing an Array in Java
- Two dimensional array in java
- Java Variable Arguments explained
- Add, update, read array elements
- Sorting and searching in array
- Java String Array to String
- How to copy arrays in Java

Concepts of Operating System

Objective: To introduce Operating System concepts with Linux environment, and to learn Shell Programming.

Text Books:

- Operating Systems Principles by Abraham Silberschatz, Peter Galvin & Greg Gagne / Wiley
- Unix Concepts and Applications by Sumitabha Das / McGraw Hill

References:

- Modern operating Systems by Andrew Tanenbaum & Herbert Bos/ Pearson
- Principles of Operating Systems by Naresh Chauhan / Oxford University Press
- Beginning Linux Programming by Neil Matthew & Richard Stones / Wrox
- Operating System : A Design-Oriented Approach by Charles Crowley / McGraw Hill

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Session 1:

Lecture:

Introduction to OS

- What is OS; How is it different from other application software; Why is it hardware dependent
- Different components of OS
- Basic computer organization required for OS
- Examples of well known OS including mobile OS, embedded system OS, Real Time OS, desktop OS server machine OS etc. ; How are these different from each other and why Functions of OS
- User and Kernel space and mode; Interrupts and system calls

Session 2:

Lecture:

Introduction to Linux

- Working basics of file system
- Commands associated with files/directories & other basic commands. Operators like redirection, pipe
- What are file permissions and how to set them
- Permissions (chmod, chown, etc); access control list; network commands (telenet, ftp, ssh, sftp, finger)
- System variables like – PS1, PS2 etc. How to set them

Shell Programming

- What is shell; What are different shells in Linux?
- Shell variables; Wildcard symbols
- Shell meta characters; Command line arguments; Read, Echo

Session 3:
Lecture:
Shell Programming

- Decision loops (if else, test, nested if else, case controls, while…until, for)
- Regular expressions; Arithmetic expressions
- More examples in Shell Programming

Sessions 4, 5 & 6: Lecture:
Processes

- What is process; preemptive and non-preemptive processes
- Process management; Process life cycle
- What are schedulers – Short term, Medium term and Long term.
- Process scheduling algorithms – FCFS, Shortest Job First, Priority, RR, Queue. Belady's Anomaly
- Examples associated with scheduling algorithms to find turnaround time to find the better performing scheduler.
- Process creation using fork; waitpid and exec system calls; Examples on process creation; Parent and child processes
- Orphan and zombie processes

Session 7: Lecture:
Signals

- What are signals
- Generating and handling signals

Threads

- What are threads; user and kernel threads; how threads are different from processes
- Thread programming using pthread.

Sessions 8 & 9:
Lecture:
Memory management

- What are different types of memories; What is the need of Memory management
- Continuous and Dynamic allocation
- First Fit, Best Fit, worst Fit
- Compaction

- Internal and external fragmentation
- Segmentation – What is segmentation; Hardware requirement for segmentation; segmentation table and its interpretation
- Paging – What is paging; hardware required for paging; paging table; Translation look aside buffer
- Concept of dirty bit
- Shared pages and reentrant code
- Throttling

Session 10:
Lecture:
Virtual Memory

- What is virtual memory
- Demand paging
- Page faults
- Page replacement algorithms

Session 11: Lecture:
Deadlock

- Necessary conditions of deadlock
- Deadlock prevention and avoidance
- Semaphore
- Mutex
- Producer consumer problem
- Dead-lock vs Starvation

Sessions 12 & 13:
Lecture:
Inter process communication

- Message queues,
- Shared memory
- Pipes
- FIFO