1. Operating system

5 System Software

5.1 Operating System

Candidates should be able to:	Notes and guidance
Explain why a computer system requires an Operating System (OS)	
Explain the key management tasks carried out by the Operating System	Including memory management, file management, security management, hardware management (input / output / peripherals), process management
Show understanding of the need for typical utility software provided with an Operating System	Including disk formatter, virus checker, defragmentation software, disk contents analysis/disk repair software, file compression, back-up software
Show understanding of program libraries	Including: • software under development is often constructed using existing code from program libraries • the benefits to the developer of software constructed using library files, including Dynamic Link Library (DLL) files

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- The need for an Operating System (OS)
  - Communicate with hardware
  - Provides an interface between software/hardware and users
  - Platform to run codes/program
- Management tasks
  - Memory management
    - Allocate RAM to programs/tasks/processes (Organization)
    - Keeps track of allocated and free memory locations (Optimization)
    - Swaps data to and from the hard drive
    - Handles virtual memory (when there is insufficient RAM)
    - Paging/segmentations
    - Ensure fair usage of memory
    - Memory protection (ensure that 2 applications cannot use the same memory location at the same time)
    - Release memory when a process stops
  - File management
    - Storage space is divided into file allocation units

    - Space is allocated to particular files
    - Maintains a file directory
    - Provides file naming conventions
    - Implement access rights
    - Specifies tasks that can be performed on a file (e.g. open, close, delete, copy, create, move etc.)
- Security management
    - Sets up user account
    - Check username and password
    - Implement access rights
    - Automatic backup
    - System restore / roll back
    - Prevent unauthorized access
    - Ensure privacy of data
    - Provision for recovery when data is lost
    - Firewall
    - Anti-virus software
    - Carrying out operating system update
- Hardware management
    - Installation of appropriate driver software
    - Manage interrupts
    - Sending control signals to the device
    - Control of buffers
    - Management of queues
    - Control access to data being sent to/from hardware
    - Control access to hardware/peripherals
    - Manages communication between devices / hardware and software
- Process management
    - Allocation of processor time
    - Scheduling of processes or tasks
    - Ensure fair access
    - Handles priority
    - Allow multitasking
    - Resolution of conflict when two or more processes require the same resource

        - Manages the resources the processes need
        - Enables processes to share information
- Utility softwares
    - Disk formatter
        - Make existing data inaccessible
        - Partitions the disk into logical drives
        - Sets up the file system
        - Prepares the disk for initial use
        - To configure the disc for use
        - To initialize a file system
        - To install a boot sector
        - To check for all the sectors and mark bad sectors
    - Virus checker
        - Scans files stored on a computer system for malicious code
        - Scans files when they enter the system / memory stick inserted
        - Compare possible virus against a database of known virus
        - Carries out heuristic checking
        - Sets up schedule for virus-checking
        - Isolates/quarantine/deletes viruses
    - Defragmentation software
        - Reorganizes the disk contents
        - Moves split files so they are contiguous
        - Creates a larger area of free space
        - To reduce head movement
    - Disk repair software
        - Check for any errors on the disk
        - Resolves any errors on the disk
        - Retrieves data from a damages disk / recovers disk when the data corrupt
        - Marks bad sectors on the disk as unusable
    - File compression
        - Compresses data before writing it to the hard disk
        - Decompresses it again when reading this data
        - Increase the capacity
    - Back-up software

        - Creates a copy of the contents of a disk. Can be set up to automatically backup
        - Allows the user to decide what is backed up
        - Allows the user to set up an off-site backup
        - May encrypt the backup files
        - restores the data if necessary
- Program libraries
    - Pre-compiled
    - Collection of functions/routines
    - Each function/routine performs a specific task/purpose
    - The program library can be referenced/imported
    - The functions/routines can be called in the original program
    - Use Dynamic Link Library (DLL) files
    - Benefits
        - Code is already tested, so it is more likely to work
        - Saves programming time, because codes do not have to be rewritten from scratch
        - Can be written in a different programming language, so special features of that language can be used
        - The programmer can use functions that they may not know how to code
        - If there’s an improvement in the library routine, the program updates automatically
        - Simplifies the program, since just the name of the function is included in the source code