DEPARTMENT OF ANIMAL HEALTH PRODUTION TECHNOLOGY
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ASSIGNMENT ON

QUESTION 1

a. Define a computer and explain its four major functions.
b. Describe the basic components of a computer system with examples.

QUESTION 2

a. Differentiate between hardware and software.
b. Explain the two main types of software, giving at least three examples each.

QUESTION 3

a. Explain the concept of booting.
b. Describe the step-by-step booting process of a computer system.

QUESTION 4

a. Define file management.
b. Explain five common file operations and their importance.

QUESTION 5

a. Discuss the applications of computers in healthcare or animal health services.
b. Highlight four common computer problems and their solutions.

BY

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2024/HND/38405/AHPT

COURSE TITLE:
COMPUTER APPRECIATION AND APPLICATION

COURSE CODE:
COM 311

COURSE LECTURER:
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APRIL, 2026

QUESTION 1

a. Definition of a Computer and Its Four Major Functions

What is a computer?

A computer is an electronic machine that accepts raw data, processes it according to a set of instructions (a program), produces useful information, and stores the results for later use. Unlike simple mechanical devices, a computer can be programmed to perform many different tasks by changing its software. Computers range from tiny embedded systems in appliances to powerful supercomputers. At the most basic level, they work with binary digits (bits) – zeros and ones – to represent numbers, text, images, sounds, and videos.

The four major functions (information processing cycle):

1. **Input**: Capturing raw data and converting it into a form the computer can understand. Without input, the computer has nothing to work with.

Examples: Keyboard (typing), mouse (pointing/clicking), microphone (sound to digital), scanner (image to digital), touchscreen (touch/gestures).

2. **Processing**: Performing arithmetic calculations, logical comparisons, and data manipulation according to program instructions. This is done by the Central Processing Unit (CPU), which contains the Arithmetic Logic Unit (ALU) for calculations and the Control Unit (CU) for directing operations.

Examples: Adding numbers, comparing passwords, sorting lists, applying photo filters, speech recognition.

3. **Output**: Presenting processed data to the user or another system in a readable form. Output devices convert binary signals into visuals, sounds, or physical actions.

Examples: Monitor (visual), printer (paper), speakers (sound), projector (large screen), actuator (physical movement).

4. **Storage**: Saving data, instructions, and information permanently, even after the computer is turned off. Unlike RAM (temporary), storage devices retain data.

Examples: Hard Disk Drive (HDD), Solid State Drive (SSD), USB flash drive, memory card, optical discs (CD, DVD, Blu-ray).

b. Basic Components of a Computer System with Examples

A computer system consists of hardware (physical parts), software (instructions), and sometimes firmware. The essential hardware components are:

1. Central Processing Unit (CPU): The "brain" that executes instructions. Modern CPUs have multiple cores for multitasking.

Examples: Intel Core i7-13700K, AMD Ryzen 9 7950X, Apple M2.

2. Memory (Primary Storage): Holds data currently in use. RAM is volatile (lost on power off); ROM is non-volatile (contains firmware like BIOS/UEFI).

Examples: DDR5 RAM (16GB/32GB), LPDDR5 (smartphones), ROM chip on motherboard.

3. Storage Devices (Secondary Storage): Long-term, non-volatile storage. Slower than RAM but larger capacity.

Examples: SSD (Samsung 990 Pro), HDD (Seagate BarraCuda), USB flash drive, NVMe M.2 drive.

4. Input Devices: Send data and commands to the computer.

Examples: Keyboard, mouse, touchpad, microphone, webcam, barcode scanner, biometric scanner.

5. Output Devices: Present results to the user.

Examples: Monitor, printer, speakers, headphones, projector, vibration motor.

6. Motherboard: Main circuit board connecting all components, providing power and communication pathways.

Examples: ASUS ROG Strix Z790-E, MSI B550 Tomahawk, Raspberry Pi PCB.

7. Power Supply Unit (PSU): Converts AC wall power to DC voltages needed by components.

Examples: Corsair RM850x, EVGA 500 W1, laptop AC adapter.

QUESTION 2

a. Difference between Hardware and Software

Hardware refers to all physical, tangible parts of a computer – things you can see and touch. Hardware exists in physical space, can wear out, overheat, or fail. It requires electricity to function.

Examples: CPU, RAM, motherboard, keyboard, monitor, SSD.

Software refers to intangible instructions and programs that tell hardware what to do. Software is stored on hardware but has no physical mass. It doesn't wear out but can have bugs or become outdated. It can be copied, modified, or deleted without changing the hardware.

Examples: Microsoft Windows, Adobe Photoshop, Google Chrome, antivirus programs.

b. Two Main Types of Software with Examples

1. System Software: Manages hardware resources and provides a platform for running application software. It runs in the background and is essential for the computer to function.

Key functions: booting, memory management, device control, security, user interface.

· **Operating System (OS)**: The most fundamental system software.

Examples: Windows 11, macOS Ventura, Ubuntu Linux, Android 13, iOS 16.

What it does: Manages files, launches apps, allocates memory, handles input/output, enforces security.

· **Device Drivers**: Specialized programs that allow the OS to communicate with specific hardware.

Examples: NVIDIA Game Ready Driver, HP Universal Print Driver, Realtek audio driver.

What it does: Translates OS commands into device-specific instructions; without the correct driver, a device may not work properly.

· **Utility Software**: Tools for maintenance, optimization, and analysis.

Examples: Antivirus (Windows Defender), disk defragmenter, backup software (Time Machine), compression tools (WinRAR), disk cleanup.

What it does: Removes temporary files, defragments drives, scans for malware, etc.

2. Application Software: Designed for end users to perform specific tasks. It runs on top of system software.

Key functions: productivity, communication, entertainment, creativity, data management.

· **Word Processing Software**: Create, edit, format, and print text documents.

Examples: Microsoft Word, Google Docs, LibreOffice Writer, Apple Pages.

· **Web Browsers**: Retrieve and display content from the World Wide Web.

Examples: Google Chrome, Mozilla Firefox, Microsoft Edge, Safari, Opera.

· **Spreadsheet Software**: Organize data in rows and columns, perform calculations, create charts.

Examples: Microsoft Excel, Google Sheets, LibreOffice Calc, Apple Numbers.

QUESTION 3

a. Concept of Booting

Booting (from "bootstrap") is the process of initializing hardware, loading the operating system into RAM, and preparing the computer for use. When you press the power button, the hardware has no OS in memory – booting brings the system from an off or reset state to a fully functional state.

Why necessary: RAM is volatile and loses data when power is off. At startup, RAM contains random noise, so a special procedure is needed to load the OS from permanent storage.

Two types:

· **Cold boot (hard boot):** Starting from a completely powered-off state. Full POST (Power-On Self-Test) runs, so it takes longer.

· **Warm boot (soft boot)**: Restarting without cutting power. Faster because some initializations are skipped. Triggered by software (e.g., clicking Restart, Ctrl+Alt+Delete).

b. Step-by-Step Booting Process

1. Power-on & hardware initialization: PSU stabilizes voltages, sends Power Good signal, CPU starts executing firmware from a predefined address.

2. CPU executes firmware (BIOS/UEFI): Initializes minimum hardware (memory controller, chipset, timer).

3. POST (Power-On Self-Test): Checks CPU, RAM, motherboard, keyboard, storage controllers, graphics. Success gives a beep; failure gives beep codes or error message.

4. Hardware discovery (device enumeration): Firmware scans buses (PCIe, USB, SATA), assigns resources, executes option ROMs (e.g., graphics card BIOS).

5. Boot device selection: Firmware checks devices in a predefined boot order (e.g., SSD first, then USB, then DVD). Looks for a boot signature (MBR signature or GPT header).

6. Loading the bootloader: For legacy BIOS, reads MBR (first 512 bytes) into RAM. For UEFI, reads bootloader file from EFI System Partition (e.g., \EFI\BOOT\BOOTX64.EFI).

7. Bootloader execution & OS kernel loading: Bootloader (GRUB, Windows Boot Manager) locates the OS kernel on disk, loads it into RAM, optionally loads an initial RAM disk (initrd), passes parameters, and transfers control.

8. Kernel initialization: Sets up memory management, interrupt handling, loads device drivers, mounts the root file system, starts the first user-space process (init or smss.exe).

9. System services & user-space initialization: init (Linux) or smss.exe (Windows) starts background services, daemons, login managers, network services.

10. User login & desktop: Display manager shows login screen; after authentication, desktop environment (GNOME, Windows Explorer, macOS Finder) loads. The computer is now ready.

QUESTION 4

a. Define File Management

File management is the systematic process of creating, organizing, storing, retrieving, manipulating, protecting, and deleting files on a computer or storage system. A file is a named collection of related data stored persistently on a secondary storage device (HDD, SSD, USB, etc.). File management covers naming, directory structures (folders), metadata, access permissions, and how the operating system tracks physical locations on disk.

Without file management, data would be an unorganized mass of bytes, making it impossible to find or reuse information. The OS's file system (NTFS, ext4, APFS) provides the underlying mechanism, while file manager applications (Windows File Explorer, macOS Finder) give users a graphical interface.

Key objectives: organization, storage efficiency, data integrity, access control, backup/recovery, performance.

Components: file system software, file manager application, naming rules, metadata (size, dates, permissions), directory hierarchy.

b. Five Common File Operations and Their Importance

1. Create: Makes a new empty file or folder. The OS allocates a directory entry, sets metadata, and marks the file as empty.

Importance: Foundation of all data storage; enables organization (folders); allows temporary workspace for applications.

2. Open: Establishes a connection between a program and an existing file, checks permissions, and returns a file handle. The file's metadata is loaded into memory.

Importance: Gatekeeper of access; enforces security; allows concurrency control (locks); required before reading or writing.

3. Read: Retrieves a specified amount of data from an open file and copies it from storage into RAM. The file pointer advances.

Importance: Access to existing information; program execution; data analysis; streaming media.

4. Write: Transfers data from RAM to an open file, either adding new content or overwriting existing content. The file may grow.

Importance: Saves user work; populates new files with content; enables logging, updates, and modifications.

5. Delete: Removes a file or directory from the file system. The directory entry is removed, and storage space is marked as free. Data usually remains on disk until overwritten (allowing recovery).

Importance: Frees storage space; maintains data hygiene; enables version control and cleanup.

QUESTION 5

a. Applications of Computers in Healthcare or Animal Health Services

Computers have transformed both human and animal healthcare. Key applications include:

· **Electronic Health Records (EHR)**: Digital patient records (history, medications, allergies, test results) that can be shared across providers. In veterinary medicine, practice management software tracks animal records.

· **Medical Imaging**: Computers process images from X-ray, CT, MRI, ultrasound, and PET scans. They enhance contrast, reconstruct 3D models, and store images digitally.

· **Telemedicine**: Remote consultations via video conferencing, allowing patients in rural areas to see specialists. Animal telemedicine lets pet owners consult vets remotely.

· **Computer-Assisted Surgery & Robotics**: Robotic systems (da Vinci, Mako) translate surgeon movements into precise instrument control. Computer navigation helps avoid critical areas in neurosurgery.

· **Clinical Decision Support Systems (CDSS)**: Software that analyzes patient data and gives evidence-based recommendations, such as drug interaction alerts or diagnosis suggestions.

· **Laboratory Information Systems (LIS)**: Automated lab analyzers send results directly to computers, with barcode tracking and abnormal result flagging.

· **Health Informatics & Epidemiology**: Large-scale data analysis for disease surveillance, genomic sequencing, and predictive modeling (e.g., sepsis risk). Animal health tracking (OIE) monitors foot-and-mouth disease, avian influenza, etc.

· **Pharmacy Management**: Computerized physician order entry (CPOE) checks for errors; automated dispensing cabinets and robotic pill counters improve accuracy.

· **Wearable Devices & Remote Monitoring**: Smartwatches track heart rate and detect falls; continuous glucose monitors (CGM) send readings to phones; implantable pacemakers can be checked remotely.

· **Animal-Specific Applications**: RFID ear tags for livestock tracking; precision farming sensors detect early illness; pet microchip databases link chips to owners; equine motion capture analyzes gait.

b. Four Common Computer Problems and their Solutions

1. Slow Performance

Symptoms: Long load times, freezes, slow boot.

Causes: Insufficient RAM, fragmented HDD, too many startup programs, malware, full drive, old hardware.

Solutions: Close unused programs; add RAM; disable startup items; run disk cleanup; defragment HDD (not SSD); scan for malware; upgrade to SSD.

2. Computer Won't Turn On or Boot

Symptoms: No power, black screen, beep codes, "no bootable device" error.

Causes: PSU failure, loose cables, faulty RAM, corrupt bootloader, dead CMOS battery, overheating.

Solutions: Check power connections; perform power drain (laptop); reseat RAM and cables; listen for beep codes; test minimal hardware; reset BIOS/CMOS; repair bootloader with bootrec (Windows) or GRUB (Linux); replace CMOS battery.

3. Blue Screen of Death (BSOD) or System Crash

Symptoms: Blue screen with error code (Windows) or kernel panic (macOS/Linux), sudden restart.

Causes: Bad drivers, faulty RAM, overheating, corrupt system files, insufficient PSU, malware.

Solutions: Note error code; boot into Safe Mode; update or roll back drivers; run Windows Memory Diagnostic or MemTest86; check temperatures (HWMonitor); run sfc /scannow and chkdsk /f /r; update BIOS; test with another PSU.

4. No Internet Connection or Slow Network

Symptoms: No access, slow loading, can't connect to Wi-Fi, IP configuration errors.

Causes: Router/modem issues, driver problems, IP conflict, DNS failure, firewall blocking, loose cables, ISP outage.

Solutions: Restart modem/router and PC; run network troubleshooter; check physical connections; release/renew IP (ipconfig /release /renew); flush DNS (ipconfig /flushdns); reset TCP/IP (netsh int ip reset); change DNS to 8.8.8.8; update network driver; temporarily disable IPv6; check for ISP outage.