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PGDE EFAD522 (ICT)

Assignment 1

Due date: 08/03/2025

Question 1

The Central Processing Unit (CPU) is the brain of the computer and consists of the following main components:

1. Control Unit (CU) :

* Coordinates and manages all the executions of instructions.
* Decodes instructions and sends control signals to other components.
* Ensures synchronization between the different parts of the CPU

1. Arithmetic Logic Unit (ALU) :

* Performs all arithmetic operations (addition, subtraction, multiplication and division).
* Handles logical operations (AND, OR, NOT, NAND, XOR, XNOR)
* Works with registers to process data.

1. Registers:

* Small and high-speed memory locations within the CPU.
* Store data, instructions and address temporarily during the fetch decode cycle.
* Examples of registers are:
  + Program counter
  + Instruction Register
  + Memory Address Register
  + Memory Data Register

1. Cache Memory:

* Small and fast memory located near the CPU.
* Stores frequently accessed data and instructions to reduce access time.

1. Clock:

* Generates regular pulses to synchronize operations.
* Clock speed how many instructions the CPU can execute per second.

1. Bus Interface Unit:

* Manages data transfer between the CPU and other components (e.g, memory, I/O devices).
* Includes address bus, data bus and control bus.

Question 2

|  |  |  |  |
| --- | --- | --- | --- |
| Device | Application | Advantage | Disadvantages |
| Barcode Reader | Used in retail stores and inventory management. | * Fast and accurate. * Cost effective and easy to use. | * Limited to reading barcodes only. * Requires line-of-sight scanning. |
| Optical Character Recognition (OCR) | Document digitization, text extraction | * Converts printed text into editable digital formats. * Supports multiple formats. | * Accuracy depends on text quality and font. * Struggles with handwritten text |
| QR Code Reader | Marketing, ticketing, payment systems. | * Stores more data than barcodes. * Easy to scan using smartphones. | * Requires a camera and software. * Vulnerable to malicious QR codes. |
| Magnetic Ink Character Recognition (MICR) | Banking (checks), financial documents. | * High accuracy and security. * Resistant to tampering and fraud. | * Limited to specific fonts and formats. * Expensive to implement. |
| Radio Frequency Identification (RFID) | Supply chain management, access control | * No line-of-sight required. * Can read multiple tags | * High implementation cost. * Privacy and security concerns. |

Question 3

Functions of an operating system include

Process Management – manages the execution of processes and allocated CPU time, handles multitasking and ensures efficient resource utilization.

Memory Management – Allocates and deallocates memory to processes and also manages virtual memory and prevents leak of memory.

File Management – organizes and manages files on storage devices and also handles file creation, deletion and access permissions.

Device Management – Controls and coordinates hardware devices as well as managing device drivers and input and output operations.

Question 4

The fetch-execute cycle is the process by which the CPU retrieves and executes instructions. The following steps are involved:

1. Fetch
   * + The Program Counter (PC) holds the address of the next instruction.
     + The address is sent to the Memory Address Register (MAR).
     + The instruction is fetched from memory and stored in the Memory Data Register (MDR).
     + The instruction is then transferred to the Instruction Register (IR).
     + The PC is incremented to point to the next instruction.
2. Decode

* The Control Unit (CU) decodes the instruction in the IR.
* Determines the operation to be performed and the operands required.

1. Execute

* The ALU performs the required operation (arithmetic, logical, etc.).
* Results are stored in registers or memory.

1. Store

* The result of the operation is written back to memory or a register.

