Module-1
Overview of IT Industry (Theory)

1. Explain in your own words what a program is and how it functions. What is Programming?

What is a Program?

A **program** is a set of instructions written by a person (called a programmer) to tell a computer what to do.

Just like a recipe tells a cook how to make a dish,
a program tells the computer **how to do a task** — like adding numbers, showing a message, or playing a game.

How Does a Program Work?

1. **You write the instructions** in a programming language (like Python, C, or Java).
2. The computer **reads the instructions** one by one.
3. It **follows each step** to complete the task.
4. The result is shown to you — like displaying a message or giving an answer.

Example:
If you write a program to say "Hello!", the computer will read that instruction and show **Hello!** on the screen.

What is Programming?

Programming is the process of:

- Writing instructions (called **code**),
- Using a programming language,
- To make the computer do something useful.

It's like teaching the computer how to solve a problem.

2. What are the key steps involved in the programming process?

The programming process means creating a program step-by-step. Here are the main steps:

1. **Understand the Problem**
   – Know what the program should do.
   (Example: Add two numbers)
2. **Plan the Solution**
   – Think and design how the program will work.
   (Use flowcharts or steps)
3. **Write the Code**
   – Write instructions using a programming language.
   (Like Python, C, Java)
4. **Test the Program**
   – Run the program to check if it works correctly.
   – Fix any errors (called bugs).
5. **Debug and Improve**
   – Find and fix mistakes in the code.
   – Make the program better if needed.
6. **Document and Maintain**
   – Write comments or notes in the code.
   – Update the program later if changes are needed.

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3. What are the main differences between high-level and low-level programming languages?

Feature	High-Level Language	Low-Level Language
Meaning	Easy-to-understand languages for humans	Close to machine code (hardware-level)
Examples	Python, Java, C, C++, JavaScript	Assembly Language, Machine Language
Readability	Easy to read, write, and understand	Hard to read and write
Syntax	Uses English-like words (print, if, while)	Uses short codes (MOV, ADD) or binary (0s & 1s)
Speed	Slower compared to low-level	Very fast and efficient
Portability	Works on many devices/systems	Works only on specific hardware
Use	Used for general software, apps, websites	Used for system-level tasks (e.g., device drivers)

3. Describe the roles of the client and server in web communication.

Client:

- The **client** is usually a **user's device** (like a browser on a computer or phone).
- It **sends a request** to the server asking for a web page, image, or data.
- Example: When you type a website name in Chrome, your browser (client) requests that page.

Server:

- The **server** is a **powerful computer** that stores websites, files, and data.
- It **receives the request** from the client, processes it, and **sends back the response**.
- Example: The server sends you the website content to display on your browser.

Client asks — Server responds.

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4. Explain the function of the TCP/IP model and its layers

Function of TCP/IP Model and Its Layers

The **TCP/IP model** helps computers **communicate over the internet**. It breaks data into parts, sends it safely, and puts it back together on the other side.

4 Layers of TCP/IP Model:

1. **Application Layer**
   – This is where users interact.
   – Example: Web browser, email.
   – It sends data to the transport layer.
2. **Transport Layer**
   – Breaks data into small packets.
   – Ensures safe and complete delivery using **TCP** (Transmission Control Protocol).

3. **Internet Layer**
   – Adds IP addresses to data.
   – Chooses the best path to send data over the internet.
4. **Network Access Layer**
   – Sends data through wires or Wi-Fi.
   – Handles physical connection to the network.

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5. Explain Client-Server Communication

Client-Server Communication is the way two computers (called **client** and **server**) talk to each other over a network like the internet.

What is a Client?

- A **client** is a device or software (like a web browser or mobile app).
- It **sends a request** to the server for information or services.

What is a Server?

- A **server** is a powerful computer that **stores websites, files, or data**.
- It **receives the request** from the client and **sends back a response**.

How Do They Communicate?

1. The **client** sends a request (e.g., "Give me this web page").
2. The **server** receives the request.
3. The **server** processes it and prepares the answer.
4. The **server** sends the response back to the **client**.
5. The **client** displays the result to the user.

Example:

You open your browser and type `www.google.com`:

- Your browser (client) asks Google's server for the page.
- Google's server sends back the page.
- You see the Google homepage.

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6. How Does Broadband Differ from Fiber-Optic Internet?

Broadband Internet:

- **Broadband** is a general term for **high-speed internet**.
- It includes technologies like:
  - DSL (through telephone lines)
  - Cable (through TV cables)
  - Satellite

Features:

- Widely available
- Good speed, but can slow down if many users are online
- Cheaper than fiber in some areas

Fiber-Optic Internet:

- Uses **thin glass or plastic fibers** to send data as light signals
- Much **faster** and more **reliable** than other types

Features:

- Very high speed (up to 1 Gbps or more)
- Consistent performance even during heavy use
- Great for streaming, gaming, and large downloads

Key Differences:

Feature	Broadband	Fiber-Optic
Speed	Medium to High	Very High

Feature	Broadband	Fiber-Optic
Technology	Copper cables, satellites	Glass fiber cables
Reliability	May slow down	Very stable
Availability	More common	Growing but not everywhere
Cost	Usually cheaper	Can be more expensive

7. What are the Differences Between HTTP and HTTPS Protocols?

Feature	HTTP	HTTPS
Full Form	HyperText Transfer Protocol	HyperText Transfer Protocol Secure
Security	**Not secure** – data can be hacked	**Secure** – data is encrypted
Uses SSL/TLS	□ No encryption	□ Yes, uses SSL/TLS for encryption
URL Starts With	`http://`	`https://`
Data Protection	No protection of personal info	Protects passwords, banking info, etc.
Used For	Simple websites or internal networks	Secure websites like banking, shopping
Padlock Symbol	□ Not shown in browser	A padlock icon appears in the address bar

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In Simple Words:

- **HTTP**: Sends data in plain text. Anyone can read it.

- **HTTPS**: Sends data in secret code (encrypted). Safe to use.

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8. What is the Role of Encryption in Securing Applications?

What is Encryption?

Encryption is the process of **converting normal data into secret code** so that only the right person can read it.

- It protects data from **hackers** and **unauthorized access**.
- Only someone with the correct **key** can **decrypt** (unlock) and read the data.

Role of Encryption in Applications:

1. **Protects Sensitive Data**
   – Keeps passwords, credit card numbers, and personal info **safe**.
   – Even if a hacker steals the data, they **can't read it**.
2. **Secures Communication**
   – Used in secure apps and websites (like WhatsApp, banking sites).
   – Ensures messages and data are **private** and **not changed**.
3. **Builds User Trust**
   – Users feel safe using apps that protect their data.
   – Shown by **HTTPS** and **padlock** icon in browsers.
4. **Prevents Data Theft**
   – Stops attackers from reading or misusing stolen data.

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9. What is the Difference Between System Software and Application Software?

Feature	System Software	Application Software

Feature	System Software	Application Software
Purpose	Runs the computer and manages hardware	Helps users perform specific tasks
Examples	Operating System (Windows, Linux), Drivers	MS Word, Web Browser, Games, Calculator
Works With	Computer system (internal work)	End users (external tasks)
Runs On	Starts with the computer	Runs when user opens it
User Interaction	Usually works in background	Directly used by users

10. What is the Significance of Modularity in Software Architecture?

What is Modularity?

Modularity means breaking a software system into **small, separate parts** called **modules**, where each module handles **one specific task**.

Why Modularity is Important:

1. **Easy to Understand**
   – Smaller modules are easier to read and understand than one big program.
2. **Reusability**
   – A module written once can be used in other programs too.
3. **Easy to Test and Debug**
   – You can test or fix one module without affecting the rest of the system.
4. **Teamwork Friendly**
   – Different developers can work on different modules at the same time.
5. **Improved Maintenance**
   – If one module needs changes, you can update it without changing the whole system.

6. **Better Organization**
   – Code is cleaner and well-organized when divided into modules.

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11. Why Are Layers Important in Software Architecture?

What Are Layers?

In software architecture, **layers** are like building blocks.
Each layer has a specific job and handles a certain part of the application.

Example:

- **Presentation Layer** – What the user sees
- **Business Logic Layer** – Handles rules/calculations
- **Data Layer** – Stores and manages data

Importance of Layers:

1. **Clear Structure**
   – Layers make the system organized and easy to understand.
2. **Separation of Concerns**
   – Each layer focuses on one task only (e.g., UI, logic, or data).
   – Makes it easier to manage and update.
3. **Reusability**
   – Layers can be reused in other applications (like login or database code).
4. **Easy Maintenance**
   – You can fix or change one layer without affecting others.
5. **Team Collaboration**
   – Different teams can work on different layers at the same time.
6. **Improved Testing**
   – You can test each layer separately for better quality control.

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12. Explain the Importance of a Development Environment in Software Production

What is a Development Environment?

A **development environment** is the **set of tools and software** that programmers use to **write, test, and build** applications.

It includes:

- **Code Editor/IDE** (like VS Code, PyCharm)
- **Compiler/Interpreter**
- **Debugger**
- **Version Control** (like Git)
- **Libraries & Frameworks**

Why is it Important?

1. **Helps Write and Test Code Easily**
   – Provides tools like auto-complete, suggestions, and error checking.
2. **Faster Development**
   – Developers can write, test, and fix code in one place.
3. **Debugging Support**
   – Makes it easier to find and fix errors (bugs) in the program.
4. **Project Management**
   – Keeps files, folders, and resources organized.
5. **Team Collaboration**
   – Tools like Git allow teams to work together without losing code.
6. **Build and Deployment Tools**
   – Helps convert the program into an installable or web-ready format.

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13. What is the Difference Between Source Code and Machine Code?

Feature	Source Code	Machine Code
Definition	Code written by a programmer in a language like Python, C, or Java	Code in 0s and 1s that the computer can understand

Feature	Source Code	Machine Code
Readable By	Humans	Computers (not humans)
Written In	High-level languages	Binary (Low-level)
Needs	Needs to be compiled or interpreted	Doesn't need further translation
Example	`print("Hello")`	`01001000 01100101 01101100 01101100 01101111`

14. Why is Version Control Important in Software Development?

What is Version Control?

Version control is a system that helps developers **track changes** in code, **save versions**, and **work together** without losing anything.

Why It's Important:

1. **Tracks Changes Over Time**
   – You can see what changed, who changed it, and when.
2. **Undo Mistakes**
   – If something breaks, you can go back to an older version.
3. **Team Collaboration**
   – Many developers can work on the same project without overwriting each other's work.
4. **Better Project Management**
   – Keeps code organized and helps in managing updates or features.
5. **Backup and Recovery**
   – Your code is safe and saved in different versions.

Tools like **Git** and platforms like **GitHub** make version control easy and powerful.

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15. What Are the Benefits of Using GitHub for Students?

GitHub is not just for professional developers — it's also **very helpful for students** learning programming and working on projects.

Key Benefits of GitHub for Students:

1. **Free Student Developer Pack**
   – GitHub gives students **free access to premium tools** like GitHub Pro, Canva Pro, Heroku, and more.
2. **Version Control**
   – Helps you **track changes** in your code and go back to older versions if needed.
3. **Project Management**
   – Organize files, issues, tasks, and updates in one place.
4. **Collaboration**
   – Work together with classmates on group projects easily and safely.
5. **Portfolio Building**
   – Upload your work and create a **public portfolio** to show your skills to teachers and future employers.
6. **Learning Git & Real Tools**
   – Learn how real developers work using **Git** and **GitHub** — a valuable career skill.
7. **Access Anywhere**
   – Store your code in the cloud and access it from **any device, anytime**.
8. **Open Source Contributions**
   – You can contribute to real-world projects and **gain experience**.

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16. Differences Between Open-Source and Proprietary Software

Feature	Open-Source Software	Proprietary Software
Access	Source code is **open and free to use**	Source code is **closed and private**

Feature	Open-Source Software	Proprietary Software
Modification	Users can **edit and customize** the code	Only the owner/company can change the code
Cost	Usually **free**	Often **paid** or requires a license
Community	Developed by a **community of developers**	Developed by a **company or organization**
Examples	Linux, VLC, LibreOffice, GIMP	Windows, MS Office, Adobe Photoshop

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17. How Does Git Improve Collaboration in a Software Development Team?

What is Git?

Git is a **version control system** that helps developers **track changes**, **work together**, and **manage code** efficiently.

Ways Git Improves Team Collaboration:

1. **Multiple People Can Work Together**
   – Each developer can work on their **own copy of the project** without affecting others.
2. **Branching**
   – Developers can create **branches** to work on new features or fixes.
   – These branches can later be **merged** into the main project.
3. **Change Tracking**
   – Git keeps a record of **who made what change and when**, making it easy to review and understand updates.
4. **Conflict Management**
   – Git helps identify **code conflicts** and gives tools to **resolve them** easily.

5. **Backup and Restore**
   – Code is saved in **snapshots**, so teams can **go back to earlier versions** if something breaks.
6. **Pull Requests and Code Reviews** *(using GitHub)*
   – Team members can **review each other's work**, suggest improvements, and approve changes before they go live.

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18. What is the Role of Application Software in Businesses?

Application software helps businesses **perform specific tasks** and improve **efficiency and productivity**.

Roles of Application Software in Business:

1. **Automates Tasks**
   – Speeds up daily work like billing, payroll, or inventory.
2. **Data Management**
   – Stores, organizes, and manages customer or product information.
3. **Communication**
   – Helps in emails, video meetings, and sharing documents.
4. **Decision Making**
   – Tools like Excel or Business Intelligence (BI) software help analyze data and make smart decisions.
5. **Customer Service**
   – Software like CRM (Customer Relationship Management) helps manage customer interactions.
6. **Marketing and Sales**
   – Helps in creating ads, managing websites, and tracking sales.

Examples: MS Word, Excel, Tally, Zoom, CRM tools, ERP software

Software Development Process

The **Software Development Process** is the step-by-step method to **create, test, and maintain** software.

Main Steps:

1. **Requirement Gathering**
2. **Planning**
3. **Design**
4. **Development**
5. **Testing**
6. **Deployment**
7. **Maintenance**

19. What Are the Main Stages of the Software Development Process?

The **Software Development Process** is a set of steps used to **plan, build, test, and maintain** software.

Main Stages:

1. **Requirement Gathering**
   – Understand what the users or business need.
   – Example: What should the software do?
2. **Planning**
   – Decide the time, budget, tools, and team needed.
   – Create a roadmap for development.
3. **Design**
   – Plan how the software will look and work (UI, system flow, database).
   – Create diagrams or wireframes.
4. **Development (Coding)**
   – Write the actual code using programming languages.
   – Build the software step-by-step.
5. **Testing**
   – Check if the software works correctly.
   – Fix bugs and errors before releasing.
6. **Deployment**
   – Launch the software so users can start using it.
   – May be done in parts or all at once.
7. **Maintenance & Updates**
   – Fix issues after release, add new features, and improve performance.

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20. Why is the Requirement Analysis Phase Critical in Software Development?

What is Requirement Analysis?

Requirement analysis is the phase where developers **gather and understand what the user or client wants** the software to do.

Why It's Critical:

1. **Clear Understanding of Needs**
   – Helps the development team know **exactly what to build**.
2. **Avoids Mistakes**
   – Saves time and cost by **preventing wrong features** or missing functions.
3. **Guides the Whole Project**
   – Acts like a **blueprint** or map for design, development, and testing.
4. **Improves Communication**
   – Makes sure developers and clients are on the **same page**.
5. **Better Cost and Time Estimation**
   – Helps in creating **realistic budgets and timelines**.

What is Software Analysis?

Software analysis is the process of **studying, understanding, and defining** the software's requirements, structure, and behavior.

Purpose of Software Analysis:

- Find out **what the software must do**
- Understand **how it will interact** with users and other systems
- Break the system into smaller parts for better planning
- Prepare documents for **design and development**

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21. What is the Role of Software Analysis in the Development Process?

Software Analysis is the phase where developers:

- **Understand the problem**
- **Define what the software should do**
- **Break down tasks and plan features**

Why It's Important:

1. **Clarifies Requirements**
   – Makes sure the software will meet the user's needs.
2. **Helps in Planning**
   – Identifies system features, inputs, outputs, and user roles.
3. **Reduces Errors**
   – Finds problems early, before coding begins.
4. **Supports Design and Testing**
   – Provides a clear base for system design and test planning.

22. What Are the Key Elements of System Design?

System Design is the process of planning how a software system will work.
It includes everything needed to build a system that is **efficient, secure, and easy to maintain**.

Key Elements of System Design:

1. **Architecture Design**
   – Describes the **overall structure** of the system
   – Divides the system into parts like front-end, back-end, and database
2. **User Interface (UI) Design**
   – Plans how the **user will interact** with the system
   – Includes buttons, forms, menus, and screens

3. **Database Design**
   – Defines how data will be **stored, organized, and accessed**
   – Involves tables, fields, and relationships
4. **Data Flow Design**
   – Shows how **data moves** between parts of the system
   – Uses diagrams like **DFD (Data Flow Diagram)**
5. **Component Design**
   – Breaks the system into **smaller modules or components**
   – Each module handles a specific task
6. **Security Design**
   – Plans how the system will protect **data and user privacy**
   – Includes login, passwords, encryption, etc.
7. **Technology Stack**
   – Decides what **tools, languages, and platforms** will be used
   – Example: Python, React, MySQL

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23. Why is Software Testing Important?

What is Software Testing?

Software testing is the process of **checking and verifying** that a software application works correctly and meets the required needs.

Importance of Software Testing:

1. **Finds Errors and Bugs**
   – Testing helps catch mistakes in the code **before the software is released**.
2. **Improves Quality**
   – Makes sure the software works properly and gives the **best performance**.
3. **Ensures User Satisfaction**
   – A tested software is **easy to use, fast, and bug-free**, which keeps users happy.
4. **Checks Security**
   – Testing helps **protect data** and makes sure no one can misuse the system.
5. **Saves Time and Cost**
   – Fixing problems early during testing is **cheaper and faster** than fixing them after release.

6. **Ensures Compatibility**
   – Makes sure the software works on **different devices, browsers, and operating systems**.

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24. What Types of Software Maintenance Are There?

Software maintenance is the process of **modifying and updating** software after it is released, to keep it **working properly** and **improve performance**.

Types of Software Maintenance:

1. **Corrective Maintenance**
   – **Fixes bugs and errors** in the software.
   – Example: Fixing a crash or wrong output.
2. **Adaptive Maintenance**
   – **Updates the software to work with new technologies** (hardware, OS, browsers).
   – Example: Updating an app to support a new version of Android.
3. **Perfective Maintenance**
   – **Improves performance or adds new features** based on user feedback.
   – Example: Making the software faster or adding a search bar.
4. **Preventive Maintenance**
   – **Cleans and improves code** to prevent future problems.
   – Example: Removing unused code or optimizing database queries.

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25. What Are the Key Differences Between Web and Desktop Applications?

Feature	Web Application	Desktop Application

Access	Runs in a **web browser** using the internet	Installed and runs on a **computer system**
Internet Required	Usually **needs internet** to work	Can work **offline** once installed
Installation	**No need to install**; just open in browser	**Must be installed** on each device
Updates	Easy to update on the **server-side**	Must update on **each computer** manually
Device Support	Can be accessed on **any device with a browser**	Works only on **specific operating systems**
Security	Needs strong **online security** (HTTPS, login)	**Local security** on device is important
Examples	Gmail, Facebook, Online Banking	MS Word, Photoshop, VLC Media Player

26. What Are the Advantages of Using Web Applications Over Desktop Applications?

Web applications are software programs that run in a **web browser** and are accessed via the **internet**.
They offer several advantages over traditional desktop applications.

Advantages of Web Applications:

1. **No Installation Needed**
   – Just open the browser and start using the app
   – Saves storage space on the device

2. **Access from Anywhere**
   – Use it from **any device** (mobile, tablet, computer) with an internet connection
3. **Automatic Updates**
   – The app is updated on the **server**, so users always get the latest version
4. **Cross-Platform Support**
   – Works on **all operating systems** (Windows, macOS, Linux, etc.) through browsers
5. **Easier Maintenance**
   – Fixes and upgrades can be made quickly without affecting user devices
6. **Collaboration-Friendly**
   – Many web apps allow **real-time collaboration**, like Google Docs or Trello
7. **Cost Effective**
   – No need to install or manage software on each device
   – Reduces IT support and maintenance cost

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27. What Role Does UI/UX Design Play in Application Development?

What is UI/UX?

- **UI (User Interface)**: How the app **looks** – buttons, colors, layout
- **UX (User Experience)**: How the app **feels** – ease of use, speed, user satisfaction

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Why UI/UX Design Is Important in App Development:

1. **First Impressions Matter**
   – A clean and attractive UI creates a **positive impression**.
2. **Improves Usability**
   – Good UX ensures the app is **easy to use and understand**.
3. **Increases User Satisfaction**
   – A well-designed app keeps users **happy and engaged**.
4. **Reduces Errors**
   – Simple and clear UI/UX helps users avoid mistakes while using the app.
5. **Boosts User Retention**
   – Users are more likely to **come back** to an app that feels smooth and helpful.
6. **Supports Business Goals**
   – Better design can lead to **more downloads, sales, or sign-ups**.

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28. What Are the Differences Between Native and Hybrid Mobile Apps?

Feature	Native Apps	Hybrid Apps
Platform Support	Built for **one platform only** (iOS or Android)	Built to work on **multiple platforms** using one code
Technology Used	Uses platform-specific languages (Java, Swift, etc.)	Uses web technologies (HTML, CSS, JavaScript)
Performance	**Faster** and smoother performance	**Slightly slower** due to web wrapper
User Experience (UX)	Offers the **best native look and feel**	May feel **less native** to users
Device Access	Full access to device features (camera, GPS, etc.)	Limited access (depends on plugins)
Development Time	Longer – separate code for each platform	Faster – single codebase for all platforms
Cost	More expensive – separate development	More cost-effective – one app for all devices

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29. What Is the Significance of DFDs in System Analysis?

What is a DFD?

DFD (Data Flow Diagram) is a visual tool used in system analysis to **show how data flows** through a system.
It explains **where the data comes from**, **where it goes**, and **how it's processed**.

Significance of DFDs in System Analysis:

1. **Easy to Understand**
   – DFDs use simple symbols (circles, arrows, rectangles), so even non-technical users can understand the system flow.
2. **Shows System Components Clearly**
   – Helps identify processes, data stores, and how they interact with users and other systems.
3. **Breaks Down Complex Systems**
   – Large systems can be divided into smaller parts, making them easier to analyze and design.
4. **Improves Communication**
   – Acts as a communication bridge between **analysts, developers, and clients**.
5. **Supports System Design**
   – Helps in designing databases, inputs, outputs, and processing steps.
6. **Finds Problems Early**
   – Helps detect **gaps, unnecessary processes, or data repetition** before development begins.

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30. Pros and Cons of Desktop Applications Compared to Web Applications

Point Desktop Applications Web Applications

Pros:

Performance	Usually faster and can use full system power	Slower, depends on internet speed and browser
Offline Access	Can work without internet	Needs internet connection in most cases
Data Security	Data is stored locally and may be more private	Data stored online; needs strong web security
Customization	Easier to customize for user needs	Customization can be limited

Cons:

Installation	Needs to be installed on each computer	No installation needed; runs in browser
Updates	Manual updates on every device	Updates are automatic and happen online
Access	Can only be used on the installed device	Can be accessed from anywhere
Cost & Maintenance	Higher setup and maintenance cost per device	Lower cost, easier to maintain centrally

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31. How Do Flowcharts Help in Programming and System Design?

What is a Flowchart?

A **flowchart** is a **diagram that shows the steps** of a process or program using **symbols and arrows**.
It helps represent the **logic and flow** of a system visually.

How Flowcharts Help:

1. **Easy to Understand**
   – Flowcharts use simple symbols to show steps, making them easy for **everyone to understand**, even non-programmers.
2. **Clarifies Logic**
   – Shows the exact **sequence of steps**, decisions, and actions in a program or system.
3. **Helps in Planning**
   – Developers use flowcharts to **plan the structure** of the program before writing code.
4. **Debugging and Testing**
   – Flowcharts help identify **errors or missing steps** in logic during development.
5. **Improves Communication**
   – Useful for explaining the system design to **team members, clients, or teachers**.

6. **Breaks Complex Problems**
   – Makes it easier to break down **big tasks into smaller parts** and understand each one clearly.