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Meeting 3

Demo

Fundamentals of Programming
TKU211131

DTETI FT UGM

Bimo Sunarfri Hantono
bhe@ugm.ac.id

Topics

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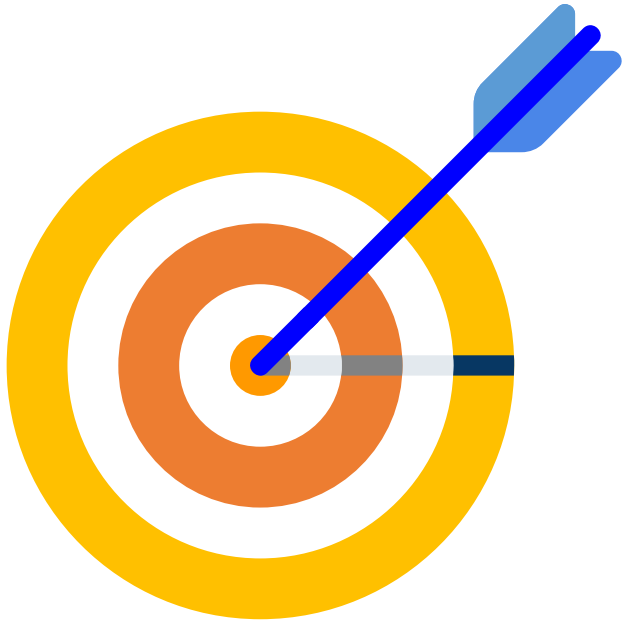
- Command Line Interface (CLI)
- Demo session: VS Code (editor) + CLI.
  - Implement Computational Thinking using:
    - Elements of a C++ program
    - Data types and operators that C++ can process
    - Basic operations in fundamental programming:
    - Performing calculations
    - Inputting data
    - Displaying results



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Command Line Interface

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What is CLI?

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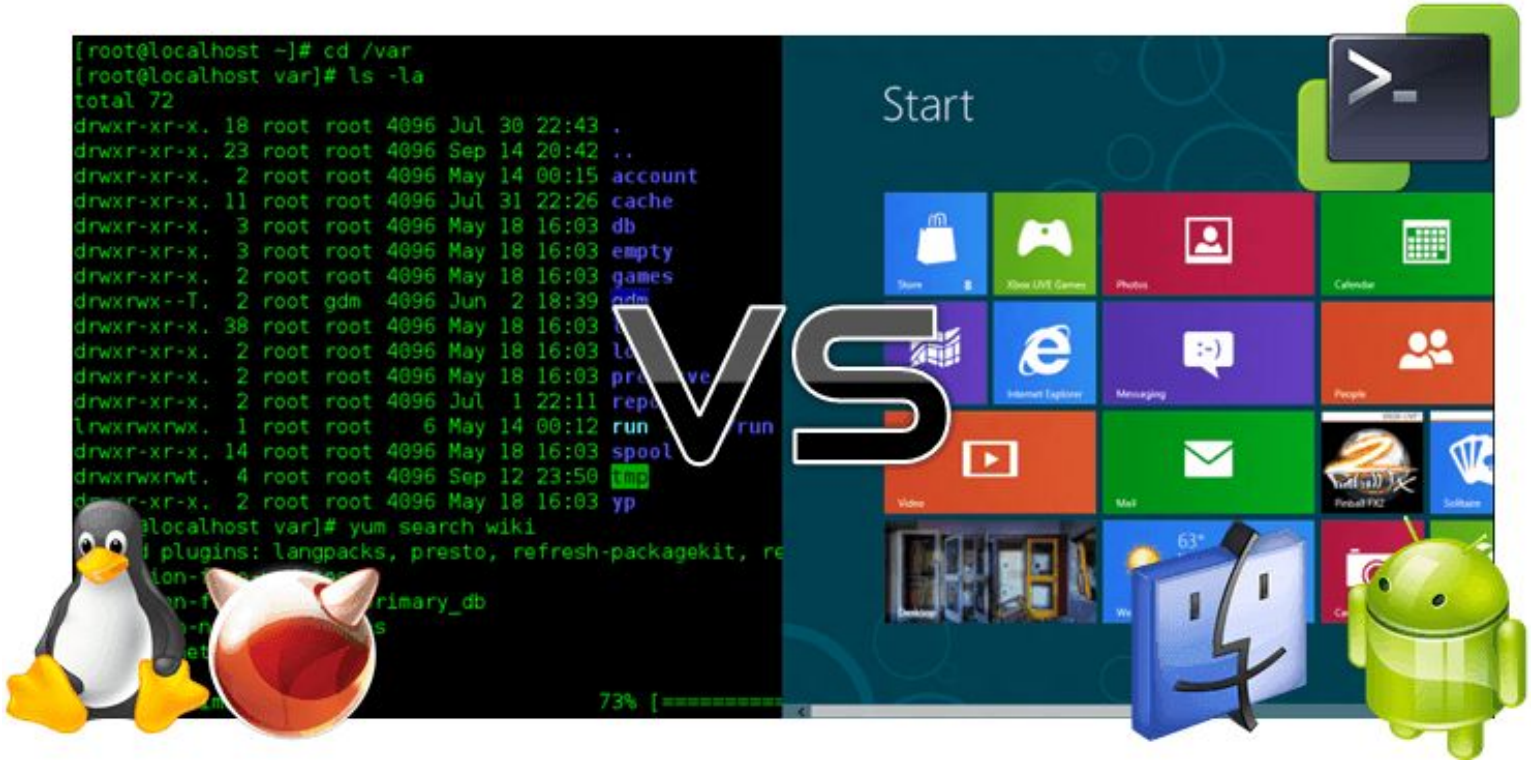
A text-based way to interact with the computer



Example of CLI in Different OS

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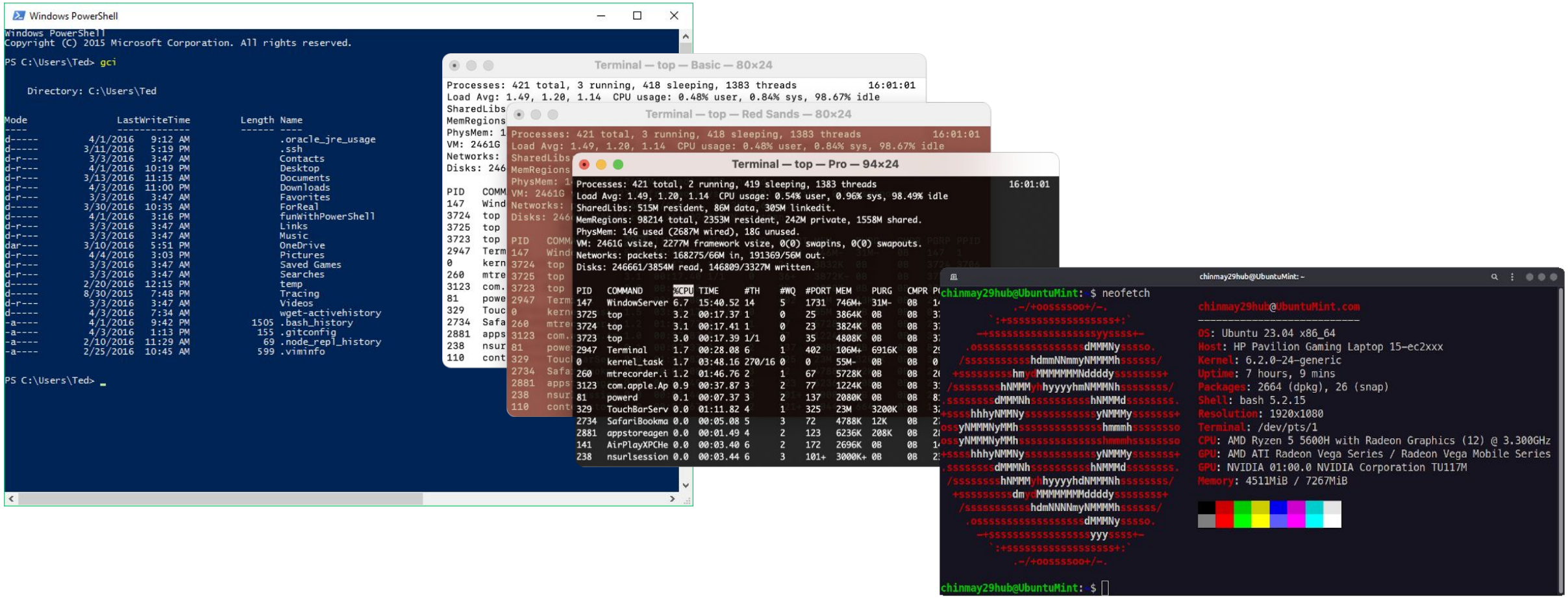

CLI vs GUI

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Aspect	CLI (Command Line Interface)	GUI (Graphical User Interface)
Interaction	Text commands typed by user	Icons, menus, and buttons
Ease of Use	Steeper learning curve (need to memorize commands)	Intuitive, easy for beginners
Speed	Very fast for experienced users	Slower due to multiple clicks
Resource Usage	Low (lightweight)	High (needs more CPU & memory)
Automation	Easy to script & automate	Limited automation
Flexibility	High (fine-grained control)	Moderate (depends on GUI features)
Examples	Terminal, PowerShell, Bash	Windows Explorer, macOS Finder

Example of CLI Command

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- cd → change directory
- ls / dir → list files
- g++ file.cpp -o file.exe → compile C++ program
- ./file.exe → run program

CLI Demo

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VS Code Tools

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Main tools in **Visual Studio Code**:

- Explorer → see project files
- Editor → write code
- Terminal → compile & run code
- Extensions → add support for C++

Useful VS Code Shortcuts

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- Ctrl + N → new file
- Ctrl + S → save file
- Ctrl + / → comment/uncomment line
- Ctrl + ` → open terminal
- Ctrl + Shift + B → build program
- F5 → run & debug program

Keyboard

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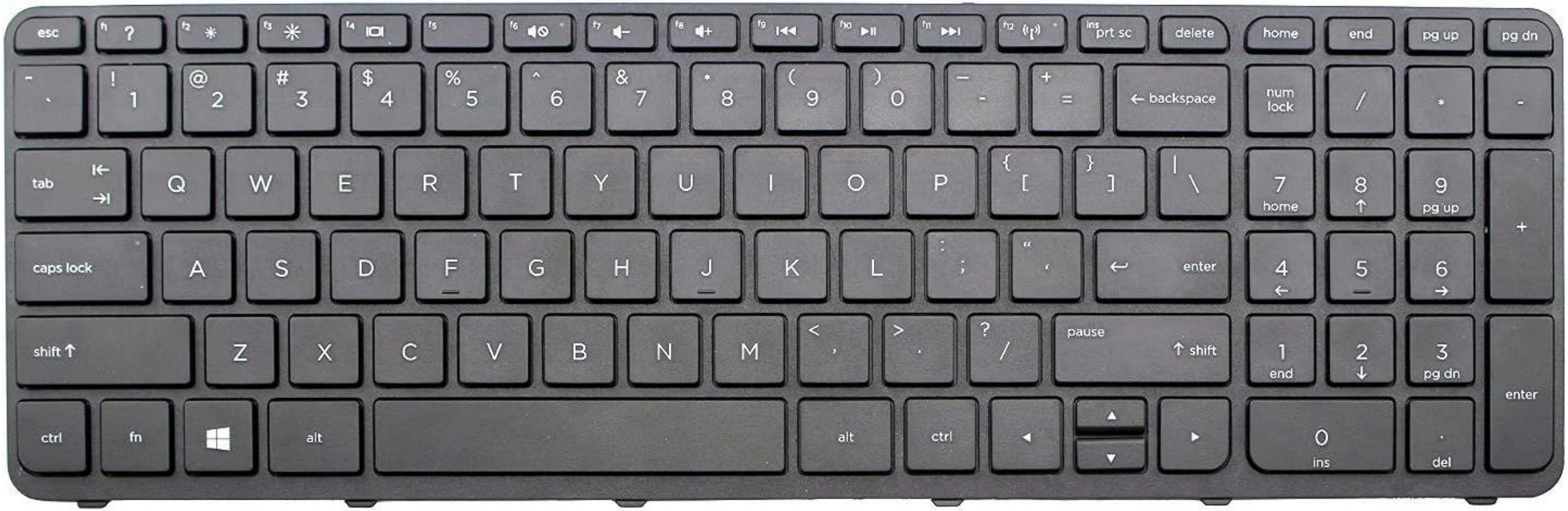

VS Code Demo

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Demo Session

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Case: Car Breakdown with Low Fuel

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Problem Definition

- **Problem:** Car stops in the middle of the road; fuel is almost empty.
- **Goal:** Get the car running again or select a safe alternative.
- **Constraints:** Time, roadside safety, limited tools.

Computational Thinking Steps

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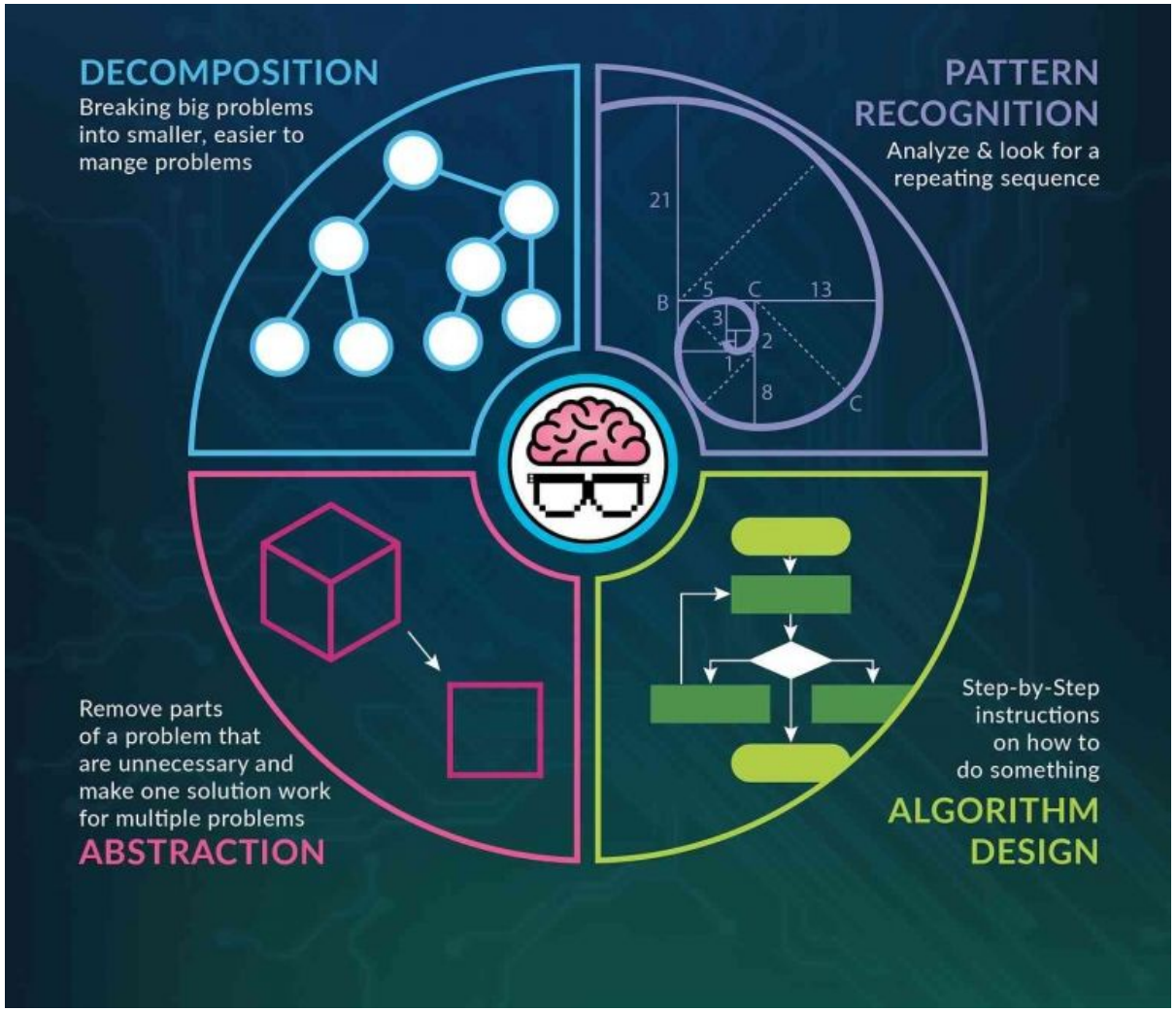
CT pillars:

1. **Decomposition** – break into checks & actions
2. **Pattern Recognition** – common car-stop causes
3. **Abstraction** – focus on fuel/battery essentials
4. **Algorithm Design** – clear, testable steps



IPO Diagram (Input – Process – Output)

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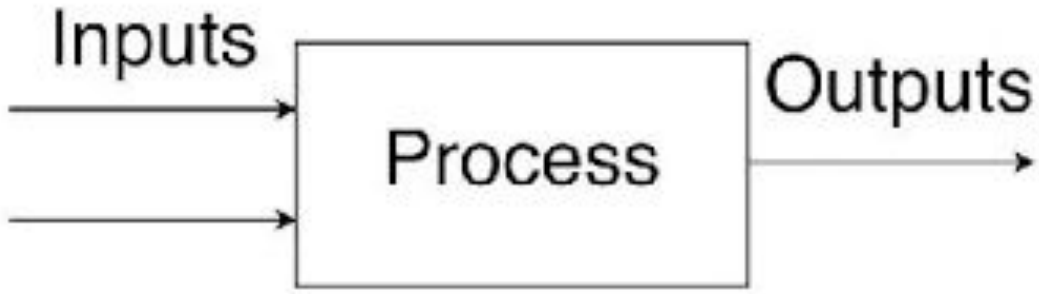
Input

- fuel_level (0 = empty, 1 = low, 2 = ok)
- battery_status (0 = weak, 1 = ok)
- has_spare_battery (true/false)



Process

1. Ensure safety (hazard lights)
2. If fuel > 0 and (battery weak or spare available) → replace battery
3. Try starting engine; if fail, recheck or call assistance
4. If fuel == empty → refuel/assistance

Output

- Decision & action: **drive to gas station** OR **call assistance**

Algorithm Design: Pseudocode

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Definition: A simplified, plain-language description of the steps in an algorithm, not tied to any programming language.

```
IF fuel > 0 AND spare battery available
    Replace battery
    IF engine starts
        Drive to gas station
    ELSE
        Call assistance
ELSE
    Refuel or call assistance
```

Algorithm Design: Flowchart

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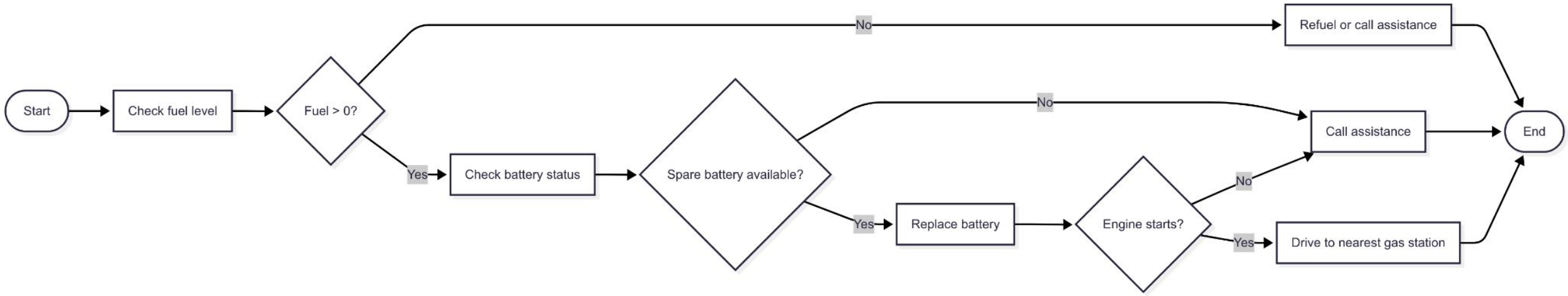

C++ Program (1)

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Elements of a C++ Program

- Preprocessor: #include <iostream>
- Namespace: using namespace std;
- Entry point: int main() { … }

```cpp
#include <iostream>
using namespace std;

int main() {
    // program starts here
    return 0;
}
```

C++ Program (2)

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Data Types and Operators that C++ Can Process

- Data types used: `int`, `bool`
- Operators shown: assignment `=`, comparison `==`, logical `||` (OR)

```cpp
int fuel_level;       // 0=empty, 1=low, 2=ok
int battery_status;   // 0=weak, 1=ok
bool has_spare_battery; // true/false
```

C++ Program (3)

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Basic Operations in Fundamental Programming

- Read → Process → Decide
- Illustrate control flow with `if / else`

```
// basic decision structure
if (fuel_level == 0) {
    // handle empty fuel
} else {
    // handle non-empty fuel
    if (battery_status == 0 || has_spare_battery) {
        // handle weak battery or replace with spare
    }
    // attempt to start engine...
}
```

C++ Program (4)

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Performing Calculations

- Compute/derive a state for decision
- Example: simple start condition

```
// naive demo calculation: assume engine can start if fuel is at least low
bool engine_starts = (fuel_level >= 1);  // derived state for decision
```

C++ Program (5)

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Inputting Data

- Use `cin` to read from keyboard
- Prompt user clearly

```
cout << "Fuel level (0=empty, 1=low, 2=ok): ";
cin  >> fuel_level;

cout << "Battery status (0=weak, 1=ok): ";
cin  >> battery_status;

cout << "Has spare battery? (0=no, 1=yes): ";
cin  >> has_spare_battery;
```

C++ Program (6)

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Displaying Results

- Use `cout` to display actions/outcomes
- Print clear guidance

```
cout << "\n-- Actions --\n";
cout << "Turn on hazard lights and place safety triangle.\n";

if (fuel_level == 0) {
    cout << "Fuel empty. Refuel or call assistance.\n";
} else {
    if (battery_status == 0 || has_spare_battery) {
        cout << "Replace or secure battery connections.\n";
    }
    cout << "Attempting to start engine...\n";
    bool engine_starts = (fuel_level >= 1); // from previous slide
    if (engine_starts) {
        cout << "Engine started. Drive carefully to the nearest gas station.\n";
    } else {
        cout << "Engine failed to start. Call assistance.\n";
    }
}
```

Compile & Execute

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- Windows
  - g++ demo_car.cpp -o demo_car.exe
  - demo_car.exe

- MacOS / Linux
  - g++ demo_car.cpp -o demo_car
  - ./demo_car

Quick Debug Tips

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- Missing `;` → check compile errors
- Wrong types → verify variable declarations
- Input confusion → echo inputs back to user
- Logic branches → print checkpoints (e.g., *entered fuel==0 branch*)

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Any Question?

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Thank You!
See you, next week, stay safe!