Module 1e: Introduction to Problem Solving and Python Fundamentals

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Algorithms

- An algorithm is a step-by-step procedure or formula for solving a problem.
- It is a sequence of instructions that can be followed to achieve a specific goal or perform a task.
- Algorithms are fundamental to computer science and programming, as they provide a clear method for processing data and making decisions.
- **YouTube: What is an Algorithm? - Cinematic version**

Why are Algorithms Important in Programming?

- Help in breaking down complex problems into manageable steps
- Make your code more efficient, organized, and easy to debug
- Foundation for building software, apps, games, AI systems, etc.
- Algorithms are used in search engines, GPS, banking, e-commerce, AI, and more!

Key Properties of a Good Algorithm

- Correctness – Solves the problem accurately
- Efficiency – Uses minimum time and resources
- Clarity – Easy to understand and implement
- Finiteness – Must end after a number of steps

Algorithm - Cooking Maggi with Egg

- Start
- Boil Water: Pour 1.5 cups of water into a small pot and bring it to a boil.
- Add Noodles: Open the Maggi noodles packet and add the noodles to the boiling water.
- Add Flavor Packet: Open the flavor packet and add it to the pot.
- Simmer: Lower the heat and simmer the noodles for 2 minutes.
- Add Egg: Crack an egg into a bowl, whisk it, and pour it into the pot.
- Stir: Stir the egg into the noodles until it is scrambled.
- Add Cheese: Stir in 0.5 cup of grated cheese.
- Serve: Serve the Maggi noodles hot.

Algorithm – Online Food Ordering System

- Start
- Display list of available restaurants
- Accept user selection of restaurant
- Display menu items of the selected restaurant
- Initialize items $\leftarrow \emptyset$
- Repeat
  - Accept item and quantity
  - Add item to items
  - Ask: "Add more items?"
- Until user says No
- Accept delivery address and payment method
- Confirm order
- Display success message
- End

Algorithm – Elevator Control System

- Start

- currentFloor ← Read elevator position

- Repeat
    - Wait for floor request (targetFloor)
    - If targetFloor > currentFloor: Move elevator up
    - Else if targetFloor < currentFloor: Move elevator down
    - If targetFloor == currentFloor:
        - Stop elevator
        - Open doors
        - Wait x seconds
        - Close doors

- Until no more requests

- End

Algorithm – Smart Irrigation System

- Start

- While true
  - moisture ← ReadSoilSensor()
  - If moisture < threshold:
    - Turn on water pump
    - Wait for wateringDuration
    - Turn off water pump
  - Wait samplingInterval

- End

Algorithm – UPI Payment Transaction

- Start
- Accept sender login and authenticate
- Accept receiver UPI ID and amount
- Check account balance
- If balance $\geq$ amount:
    - Debit sender account
    - Credit receiver account
    - Display "Transaction Successful"
- Else:
    - Display "Insufficient Balance"
- End

Algorithm – Face Recognition Attendance System

- Start

- Initialize camera and recognition module

- While class is active
  - Capture frame
  - Detect face(s)
  - For each face
    - If face matches database:
    - markPresent(studentID)
    - Else:
    - Display "Unknown face"

- Save attendance records

- End

Algorithm - Adding Two Numbers

- Start

- Read the First Number: 5.

- Read the Second Number: 3.

- Add the Numbers: $5 + 3 = 8$.

- Write the Sum: 8.

- Stop

Algorithm - Swap Two Numbers

- Start

- Take two numbers as input.

- Declare a temporary variable.

- Store the first number in the temporary variable.

- Store the second number in the first number.

- Store the temporary variable in the second number.

- Print the first and second numbers.

- End.

Algorithm - Greater among three Numbers

- Start

- Read the First Number: 5.

- Read the Second Number: 8.

- Read the Third Number: 12.

- Compare the Numbers: 5 is less than 8.

- Compare the Numbers: 8 is less than 12.

- Write the Greater Number: 12.

- Stop

Importance of Algorithms

- Algorithms can be represented in many forms, and among that there are few methods which will be used globally.

- There are few methods to represent algorithms in other forms,

- Flowchart

- Pseudocode

- It shows the logic behind algorithms without implementation.

- Non programmer also understand the flow.

Assignment

- Calculate area and perimeter of a rectangle.

- Check if a number is positive, negative, or zero.

- Find the largest of three numbers.

- Calculate total and average marks of 5 subjects.

- Check whether a given year is a leap year.

Assignment

- Set an alarm on your mobile phone.

- Register for an online course.

- Validate login with username and password.

- Withdraw cash from an ATM.

- Control traffic lights based on a timer.

Assignment

- Place an order on an e-commerce website.

- Turn on smart bulb at sunset and off at sunrise.

- Vending machine algorithm for item dispensing.

- Search student record by roll number.

- Sort 5 numbers in ascending order (algorithm only).

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Don't just code — think, plan, and solve