Programming Paradigms & Practices

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Outline

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2. Provide comprehensive insights into programming paradigms

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4. Discuss best practices for project structure and code quality
5. Overview of deployment models and strategies

Understanding Programming Paradigms

Definition *wikipedia*

Programming paradigms are fundamental styles or approaches to computer programming, offering distinct methodologies for designing and structuring software.

Importance *ChatGPT*

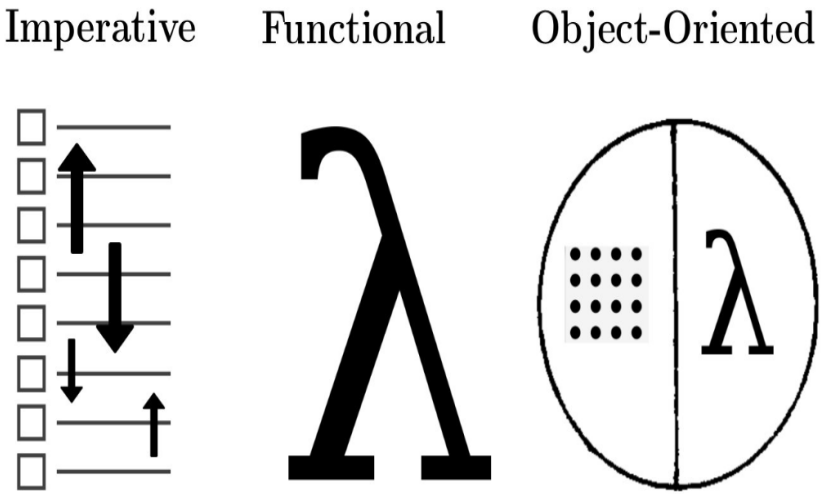
Understanding different programming paradigms is crucial for selecting the right approach to solve specific problems, leading to more efficient and maintainable code.

Historical Context **wikipedia**

Programming paradigms have evolved over time, with significant contributions from various programming languages that introduced unique features and concepts, shaping the way we write software today.

Programming Paradigms Types

- Imperative Programming
- Procedural Programming
- Object-Oriented Programming
- Declarative Programming
- Functional Programming
- Event-Driven Programming
- Aspect-Oriented Programming
- Reactive Programming



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```c
#include <stdio.h>

int main() {
  int Salaries[] = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10};
  int N = sizeof(Salaries) / sizeof(Salaries[0]);
  int result = 0, i;

  for (i = 0; i < N; i++) {
    if (Salaries[i] % 2 == 0) {
      result += Salaries[i];
    }
  }

  printf("Sum of even salaries is %d", result);
  return 0;
}
```

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#include <stdio.h>

int SumEven(int arr[], int N) {
    int sum = 0;
    int i;

    for (i = 0; i < N; i++) {
        if (arr[i] % 2 == 0) {
            sum += arr[i];
        }
    }

    return sum;
}

int main() {
    int arr[10] = {1,2,3,4,5,6,7,8,9,10};

    int result = SumEven(arr, 10);

    printf("sumi of even numbers is %d \n" , result);

    return 0;
}
```

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- *let's try an example*

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```sql
SELECT COUNT(CustomerID), Country
FROM Customers
GROUP BY Country
ORDER BY COUNT(CustomerID) DESC;
```

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```haskell
sumList :: [Int] -> Int
sumList = foldl (+) 0                          -- Higher Order Function

main = do
    let salaries = [1,2,3,4,5,6,7,8,9,10]
    print ("result = ", sumList salaries)     -- result = 55
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```java
import java.util.Arrays;

class SalarySum {

  public static void main(String[] args) {
    int[] salaries = new int[] {1, 2, 3, 4, 5, 6, 7, 8, 9, 10};

    int result = Arrays.stream(salaries)
                       .reduce(0, (a, b) -> a + b);

    System.out.println("result = " + result);   // result = 55
  }
}
```

Typing Categories

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source: Static vs Dynamic Typing: A Detailed Comparison

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Static Typing

Static typing is a typing system where variables are bound to a data type during compilation. Once a variable is assigned a data type it remains unchanged throughout the programs execution.

Dynamic Typing

Dynamic typing allows variables to be bound to data types at runtime instead of during compilation. This flexibility enables concise code and ease of use.

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Static Typing

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```cpp
//      C++ example
bool IsPrime(int number) {
  bool is_prime = true;             // Type "bool" is detected in compile time

  if (number == 0 || number == 1) {
    return false;
  }

  int i;                            // Type "int" is detected in compile time
  for (i = 2; i <= number/2; ++i) {
    if (number % i == 0) {
      is_prime = false;
      break;
    }
  }

  return is_prime;
}
```

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```python
# Program to add two matrices using nested loop
def sum_matrix():
    X = [[12,7,3],
        [4 ,5,6],
        [7 ,8,9]]

    Y = [[5,8,1],
        [6,7,3],
        [4,5,9]]

    result = [[0,0,0],
              [0,0,0],
              [0,0,0]]

    # iterate through rows
    for i in range(len(X)):
       # iterate through columns
       for j in range(len(X[0])):
          result[i][j] = X[i][j] + Y[i][j]

    for r in result:
       print(r)
```

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Static vs Dynamic Typing

Aspect	Static Typing	Dynamic Typing
Determination Time	Determined at compile-time.	Determined at runtime.
Error Detection	Errors caught during compilation.	Errors may appear during program execution.
Performance	Typically faster due to compile-time optimizations.	Possible overhead from runtime type-checks.
Coding Verbosity	Requires explicit type declarations.	Concise; types aren't specified explicitly.
Flexibility	Variables bound to one type.	Variable types can change during execution.
Type Safety	High type safety through early error detection.	Some type safety traded off for flexibility.

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Advanced Programming Techniques

- Multithreading and Concurrency

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- Reactive Programming and Asynchronous Streams
- Memory Management and Optimization
- Effective Error Handling and Debugging

Project Structure and Code Quality

- Organizing Your Codebase
- Implementing Best Practices for Readability and Maintainability
- Writing Clean and Testable Code
- Integrating Continuous Integration and Automated Testing

Deployment Models

- Understanding Different Deployment Strategies
- Containerization and Orchestration with Docker and Kubernetes
- Continuous Deployment and Delivery Pipelines
- Monitoring and Maintaining Production Environments

Conclusion

- Recap of Key Learnings
- Emerging Trends in Software Development