Data Structures and Algorithms

With Diagrams and C Code Examples

Definition of Algorithm

- An algorithm is a step-by-step procedure to solve a problem.
- Properties:
- - Input
- - Output
- - Finiteness
- - Definiteness
- - Effectiveness

Structure of Algorithm (Basic Flow)

Data Structures

- Data Structure organizes data efficiently.

- Types:
- - Primitive (int, float, char)
- - Non-Primitive
- * Linear (Array, Stack, Queue)
- * Non-Linear (Tree, Graph)

Time Complexity (Big O)

- O(1) - Constant
- O(n) - Linear
- O(n^2) - Quadratic
- O(log n) - Logarithmic

Linear Search (C Example)

```
#include<stdio.h>
int main(){
 int arr[5]={1,2,3,4,5};
 int key=3,i;
 for(i=0;i<5;i++){
  if(arr[i]==key){
   printf("Found");
   break;
  }
 }
 return 0;
}
```

Recursion Example (Factorial in C)

```
#include<stdio.h>
int fact(int n){
 if(n==0) return 1;
 else return n*fact(n-1);
}

int main(){
 printf("%d",fact(5));
 return 0;
}
```

Polynomial vs Exponential

- Polynomial: O(n), O(n^2)
- Exponential: O(2^n), O(n!)

- Polynomial algorithms are efficient.
- Exponential algorithms are slow for large inputs.

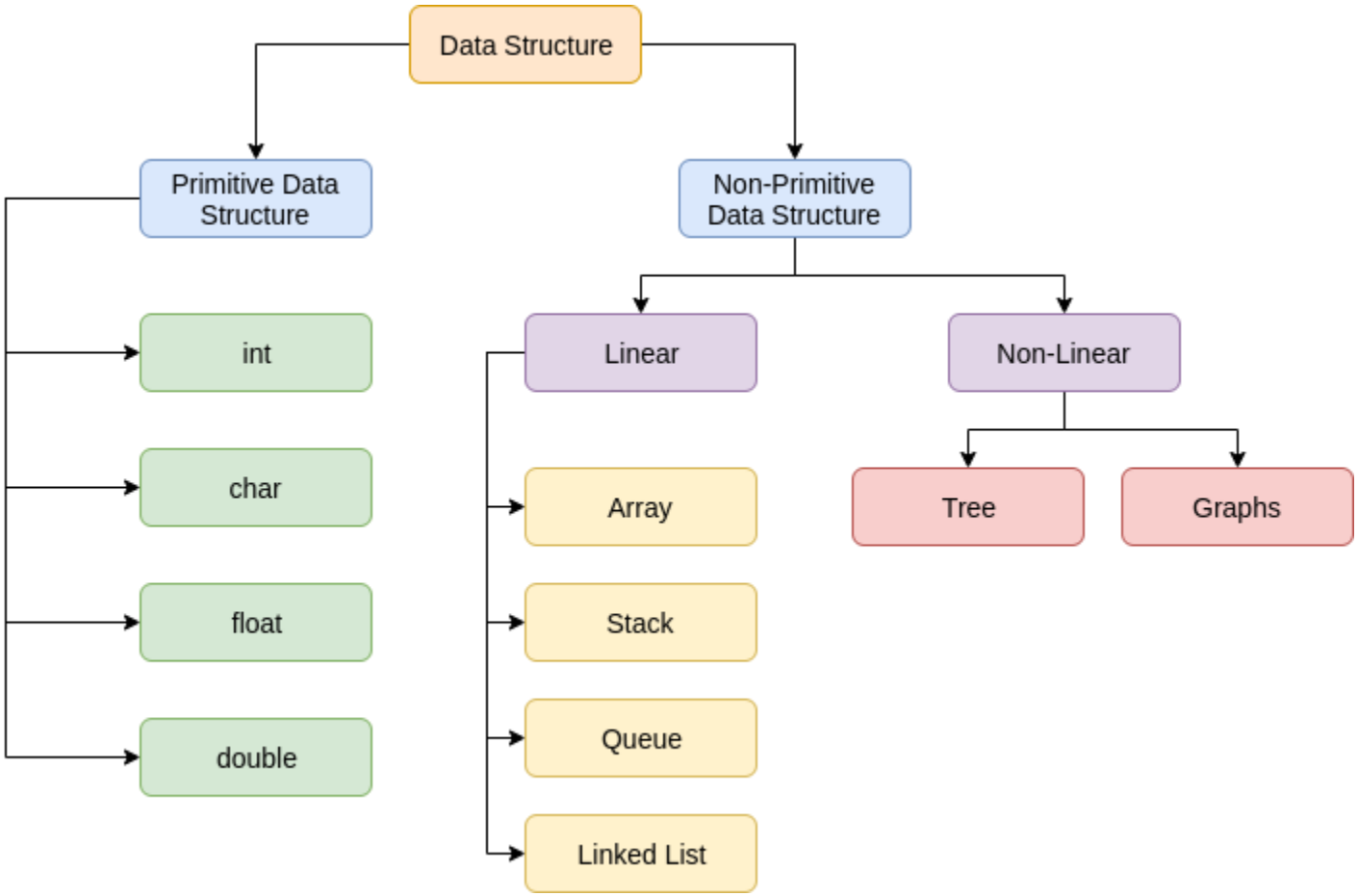
Open Source Software Development Process

- 1. Idea & Planning
- 2. Public Repository (GitHub)
- 3. Community Contributions
- 4. Testing & Review
- 5. Release & Updates

To be covered ……

- Link List using pointers
- Stack using Array and pointers
- Queue using Array and pointers
- Tree : BST, AVL, Huffman's & B/M-way tree

Flowchart


Data Structure
Primitive Data Structure
Non-Primitive Data Structure
int
char
float
double
Linear
Non-Linear
Array
Stack
Queue
Linked List
Tree
Graphs

- Stack
- 4
- A Stack follows the LIFO (Last In First Out) principle.
- Operations:
- Push
- Pop
- Peek