Lecture 12

Recursion & Arrays

INFORMATION TECHNOLOGY UNIVERSITY

QUIZ

سورة طه پارہ: 16

قَالَ رَبِّ اشْرَحْ لِيْ صَدْرِيْ ۙ ﴿٢٥﴾

[قَالَ: اس نے کہا] [رَبِّ: اے رب !] [اشْرَحْ: کھول دے] [لِيْ: میرے لیے] [صَدْرِيْ : میرا سینہ]

وَيَسِّرْ لِيْٓ اَمْرِيْ ۙ ﴿٢٦﴾

[وَيَسِّرْ: اور آسان کر دے] [لِيْ: میرے لیے] [اَمْرِيْ : میرا کام]

وَاحْلُلْ عُقْدَةً مِّنْ لِّسَانِيْ ۙ ﴿٢٧﴾

[وَاحْلُلْ: اور کھول دے] [عُقْدَةً: گرہ] [مِّنْ: سے] [لِّسَانِيْ: میری زبان]

يَفْقَهُوْا قَوْلِيْ ۖ ﴿٢٨﴾

[يَفْقَهُوْا: وہ سمجھ سکیں] [قَوْلِيْ : میری بات]

QUESTIONS / FEEDBACK / CONCERNS

UBS

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SE SEC A
SLIDE OF FAME

NO ONE
WEEK-1

Muhammad Daniyal Hammad (BSSE23046)
WEEK-2

Syed Hashim Abbas (BSSE23084)
WEEK-3

Umar Ahmad (BSSE23032)
WEEK-4

YOUR NAME
WEEK-5

YOUR NAME
WEEK-6

YOUR NAME
WEEK-7

YOUR NAME
WEEK-8

YOUR NAME
WEEK-9

YOUR NAME
WEEK-10

YOUR NAME
MIDTERM

YOUR NAME
WEEK-11

YOUR NAME
WEEK-12

YOUR NAME
WEEK-13

YOUR NAME
WEEK-14

YOUR NAME
WEEK-15

UBS

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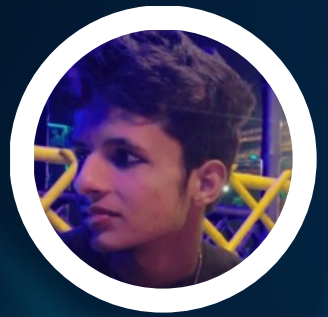
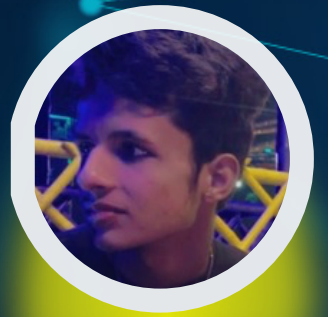
SE SEC B
SLIDE OF FAME

Muhammad Mukarram
BSSE23029
WEEK-1



Muhammad Abdullah
(BSSE23087)
WEEK-2



Muhammad Abdullah
(BSSE23087)
WEEK-3

Fasiha Rohail
(BSSE23041)
WEEK-4

YOUR NAME
WEEK-5

YOUR NAME
WEEK-6

YOUR NAME
WEEK-7

YOUR NAME
WEEK-8

YOUR NAME
WEEK-9

YOUR NAME
WEEK-10

YOUR NAME
MIDTERM

YOUR NAME
WEEK-11

YOUR NAME
WEEK-12

YOUR NAME
WEEK-13

YOUR NAME
WEEK-14

YOUR NAME
WEEK-15

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RECAP

GitHub

Tools (Cygwin, IDE, GitHub)

Approach towards a word problem

Flowcharts

Flowcharts Advantages & Disadvantages

Algorithms

Pseudocode

Numbers Systems (Decimal, Binary, Octal & Hexadecimal)

Ten’s Complement

Twos Complement

main function

Stream in and stream out operators

if else

Functions

Data Types

Arithmetic Operators

Relational Operators

Loops (While, for , do while)

Nested Loops

Switch cases

RECAP

Function Overloading

Scope of variables

Function Prototype and Definition

Default Value in parameters of functions

Parameters by value vs Parameters by Reference

Recursion

Recursive Functions

$$f(n) = 1 + 2 + 3 + \ldots\ldots + n$$

$$f(n) = 1 \qquad n=1$$
$$f(n) = n + f(n-1) \qquad n>1$$

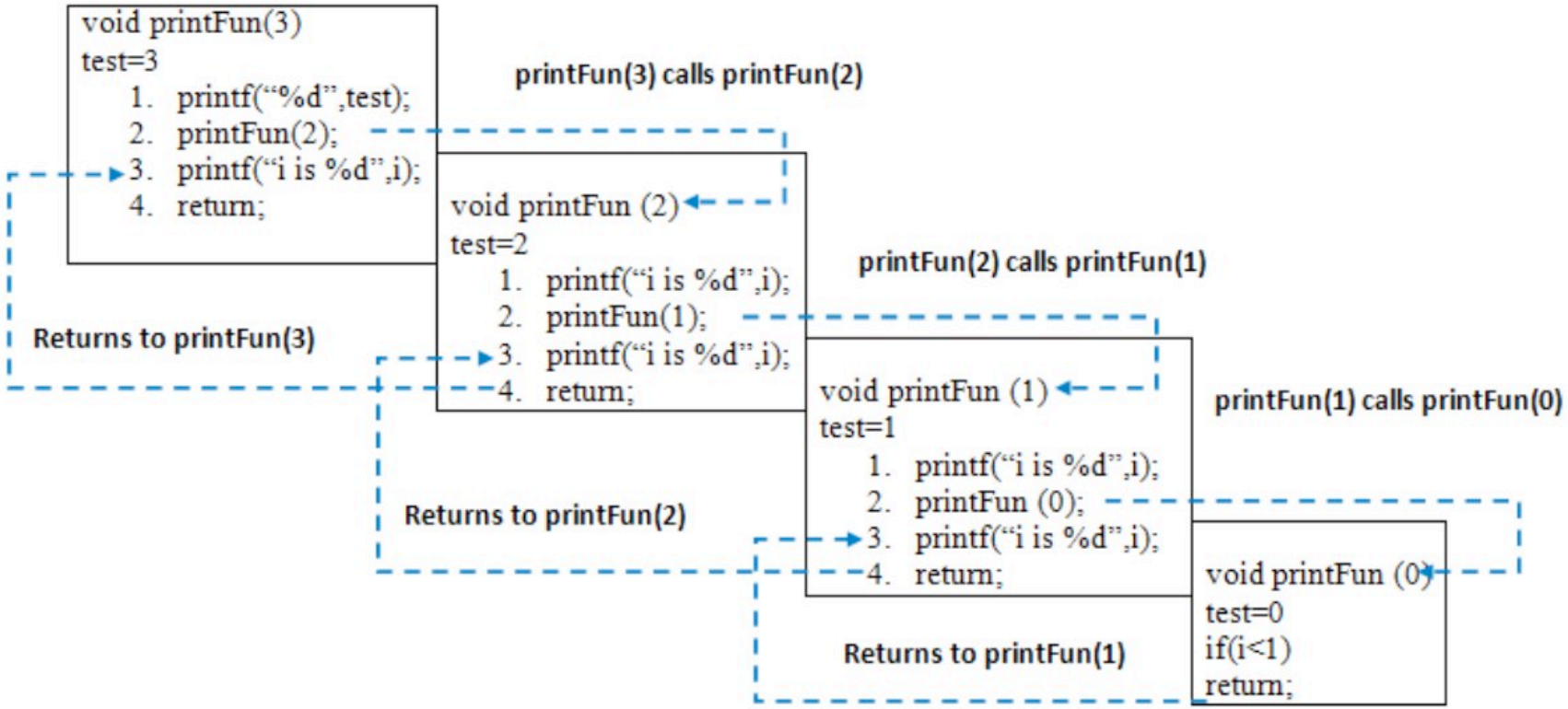
```
int f(int n)
{
    if (n == 1) // base case
        return 1;
    else
        return n+f(n-1);
}
```

```
int fact(int n)
{
    if (n <= 1) // base case
        return 1;
    else
        return n*fact(n-1);
}
```

```
#include <bits/stdc++.h>
using namespace std;

void printFun(int test)
{
   if (test < 1)
      return;
   else {
      cout << test << " ";
      printFun(test - 1); // statement 2
      cout << test << " ";
      return;
   }
}
```

3 2 1 1 2 3



```
// recursive.cpp
// Demonstrates the principle of recursion by a
// function, which reads a line from the keyboard
// and outputs it in reverse order.
// ------------------------------------------------
#include <iostream>
using namespace std;

void getput(void);

int main()
{
   cout << "Please enter a line of text:\n";
   getput();
   cout << "\nBye bye!" << endl;
   return 0;
}

void getput()
{
   char c;
   if( cin.get(c)  &&  c != '\n')
      getput();
   cout.put(c);
}
```

Recursive Functions

Recursive Functions

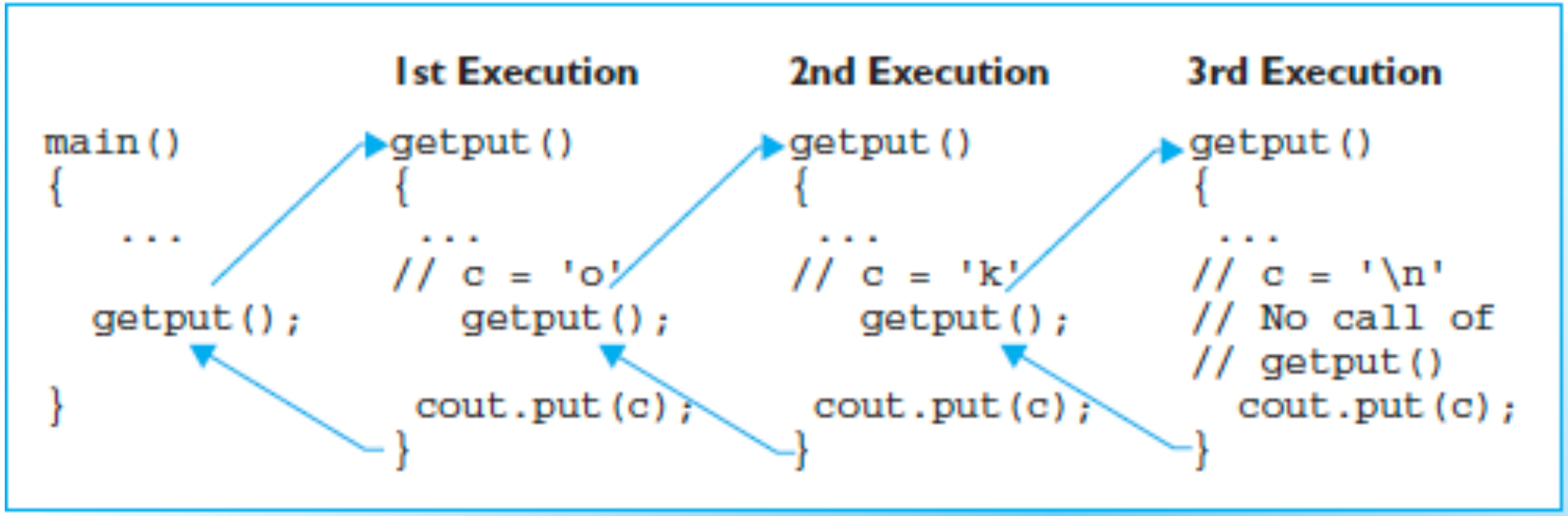


Image Reference : A Complete Guide to Programming in C++

- Series

```
1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144
```

Recursion

- Functions can call themselves.
- fib(n) = fib(n-1) + fib(n-2) can be easily expressed via a recursive implementation

```
int fibonacci(int n) {
  if (n == 0 || n == 1) {
    return 1;
  } else {
    return fibonacci(n-2) + fibonacci(n-1);
  }
}
```

Recursion

- Functions can call themselves.
- fib(n) = fib(n-1) + fib(n-2) can be easily expressed via a recursive implementation


```
int fibonacci(int n) {
  if (n == 0 || n == 1)
    { return 1;
  } else {
    return fibonacci(n-2) + fibonacci(n-1);
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}
```

Recursion

- Functions can call themselves.
- fib(n) = fib(n-1) + fib(n-2) can be easily expressed via a recursive implementation

recursive step

```
int fibonacci(int n) {
  if (n == 0 || n == 1) {
    return 1;
  } else {
    return fibonacci(n-2) + fibonacci(n-1);
  }
}
```

How to store words or sentences ?

How to store words or sentences ?

```
char str[] = "C++";
```

Alternate ways of doing the same thing

```
char str[4] = "C++";

char str[] = {'C','+','+','\0'};

char str[4] = {'C','+','+','\0'};
```

Bigger arrays are fine too

```
char str[100] = "C++";
```

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

int main()
{
    char str[100];

    cout << "Enter a string: ";
    cin >> str;
    cout << "You entered: " << str << endl;

    cout << "\nEnter another string: ";
    cin >> str;
    cout << "You entered: "<<str<<endl;

    return 0;
}
```

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

int main()
{
    char str[100];
    cout << "Enter a string: ";
    cin.get(str, 100);

    cout << "You entered: " << str << endl;
    return 0;
}
```

ARRAYS

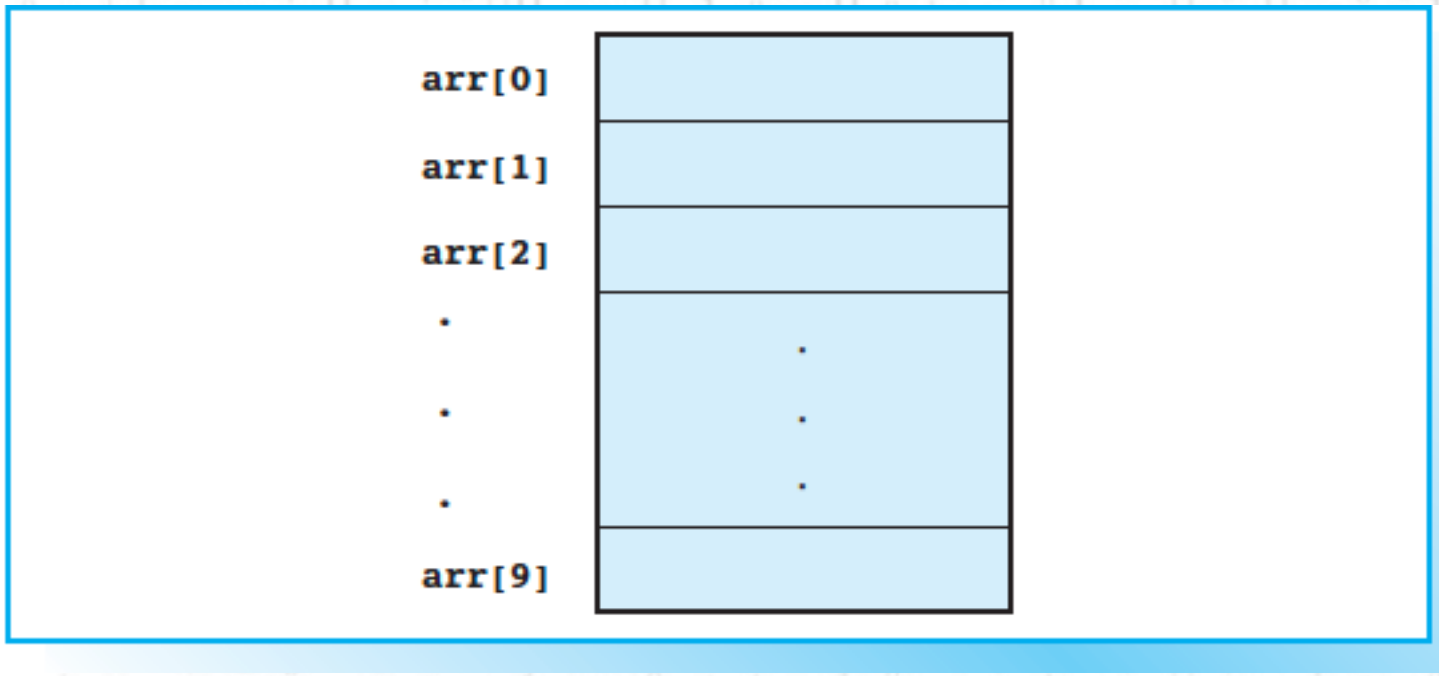

Image Reference : A Complete Guide to Programming in C++