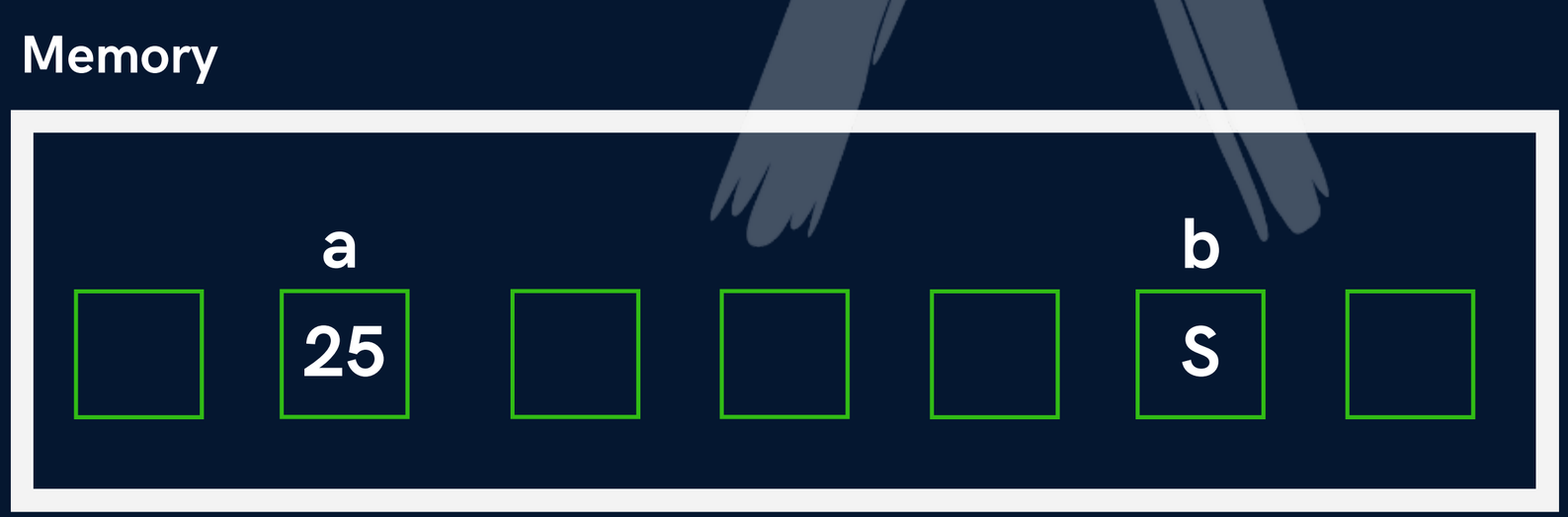
Variables

Variable is the name of a memory location which stores some data.



Variables

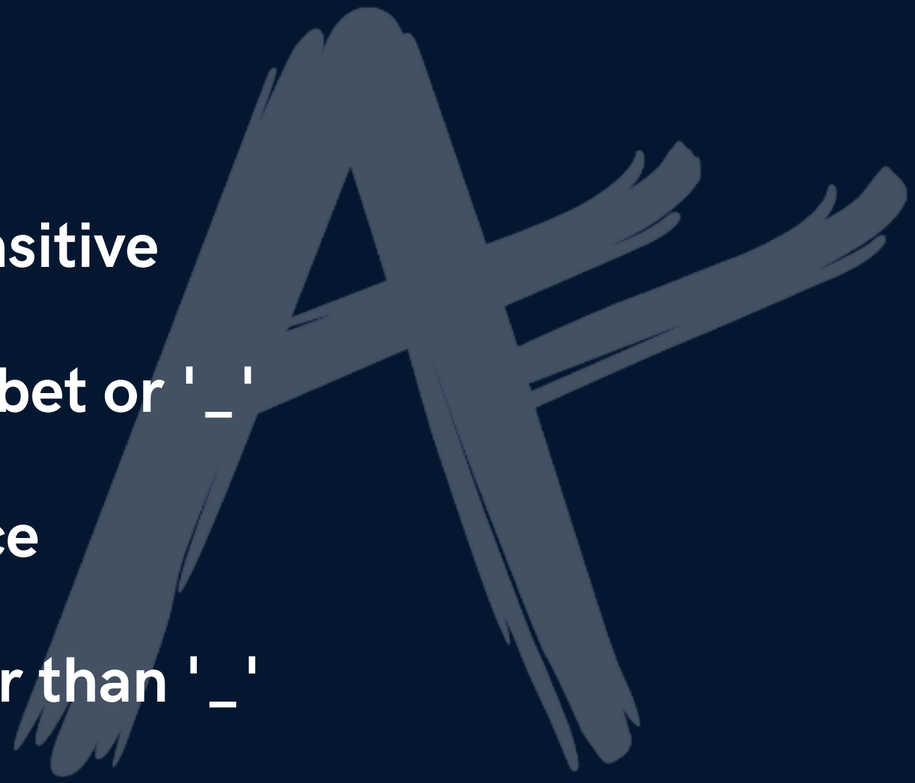
Rules

a. Variables are case sensitive

b. 1st character is alphabet or '_'

c. no comma/blank space

d. No other symbol other than '_'



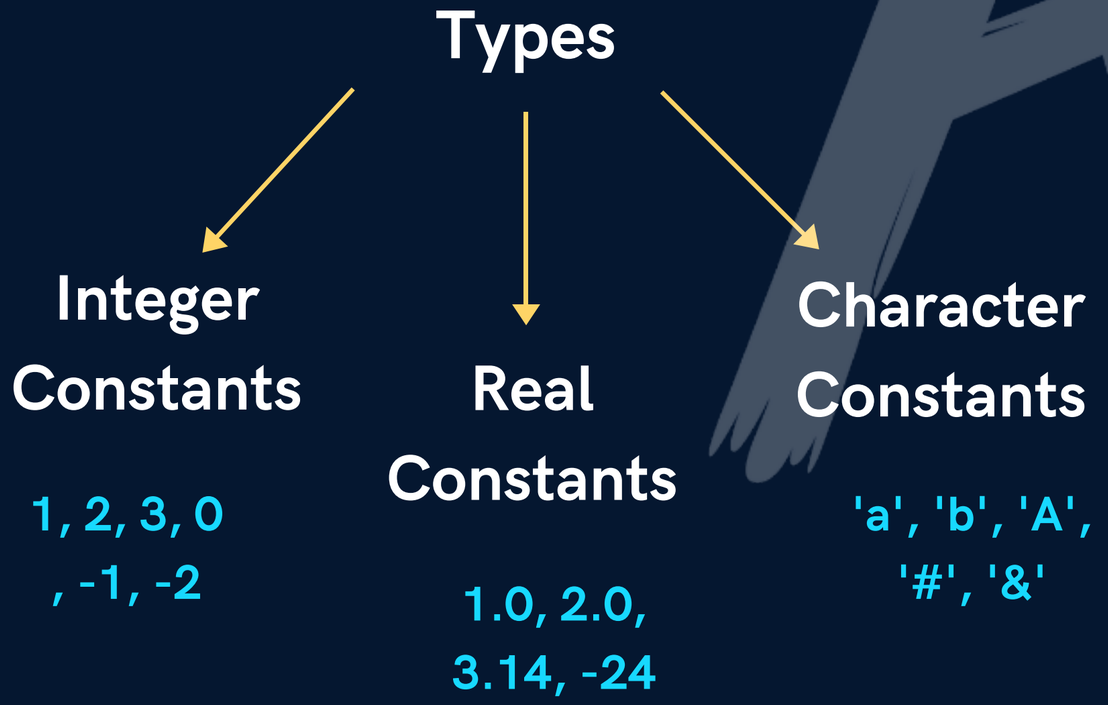
Variables

Data Types

Data type	Size in bytes
Char or signed char	1
Unsigned char	1
int or signed int	2
Unsigned int	2
Short int or Unsigned short int	2
Signed short int	2
Long int or Signed long int	4
Unsigned long int	4
float	4
double	8
Long double	10

Constants

Values that don't change(fixed)



Keywords

Reserved words that have special meaning to the compiler

32 Keywords in C

Keywords

auto	double	int	struct
break	else	long	switch
case	enum	register	typedef
char	extern	return	union
continue	for	signed	void
do	if	static	while
default	goto	sizeof	volatile
const	float	short	unsigned

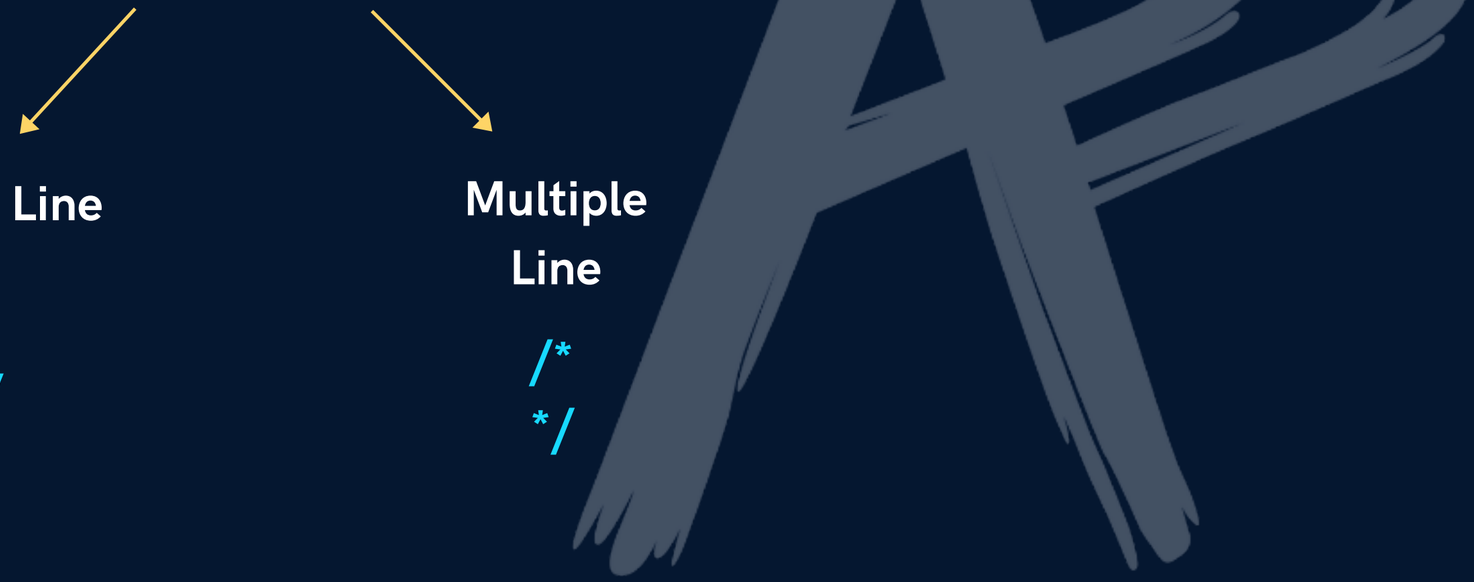
Program Structure

```c
#include<stdio.h>

int main() {
    printf("Hello World");
    return 0;
}
```

Comments

Lines that are not part of program



Single Line

//

Multiple Line

/*
*/

Output

```
printf(" Hello World ");
```

new line

```
printf(" kuch bhi \n");
```

Output

CASES

1. integers

```
printf(" age is %d ", age);
```

2. real numbers

```
printf(" value of pi is %f ", pi);
```

3. characters

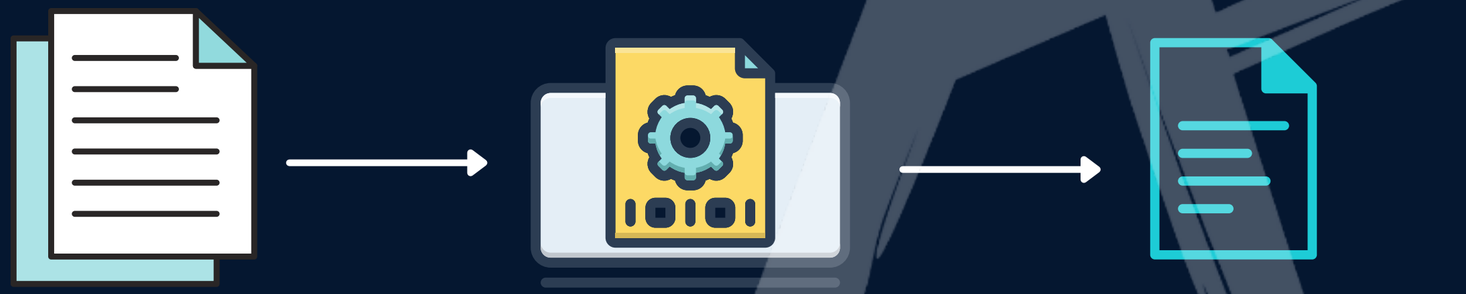
```
printf(" star  looks like this %c ", star);
```

Input

```
scanf(" %d ", &age);
```

Compilation

A computer program that translates C code into machine code



Hello.c

C Compiler

a.exe (windows)
a.out (linux & mac)

C Language Tutorial

(Basic to Advanced)

Topics to be covered :

Variables, Data Types + Input/Output

(Chapter 1)

1. **First Program**

```c
#include<stdio.h>

int main() {
   printf("Hello World");
   return 0;
}
```

2. **Variables & Data Types + Constants & Keywords**

```c
#include<stdio.h>

int main() {
   int number;
   int age;
   int price;
   return 0;
}
```

```c
#include<stdio.h>

int main() {
   int age = 22;
   float pi = 3.14;
   char percentage = '%';
   return 0;
}
```

3. Comments

```c
#include<stdio.h>
//This program prints Hello World
int main() {
   printf("Hello World");
   return 0;
}
```

4. Output

```c
#include<stdio.h>

int main() {
   int age = 22;
   float pi = 3.14;
   char percentage = '%';


   printf("age is %d", age);
   printf("age is %f", pi);
   printf("age is %c", percentage);
   return 0;
}
```

5. Input (Sum of 2 numbers)

```c
#include<stdio.h>

int main() {
   int a, b;

   printf("enter a \n");
   scanf("%d", &a);

   printf("enter b \n");
```

```
    scanf("%d", &b);

    printf("sum of a & b is : %d \n", a+b);

    return 0;
}
```

6. **Practice Qs 1 (Area of Square)**

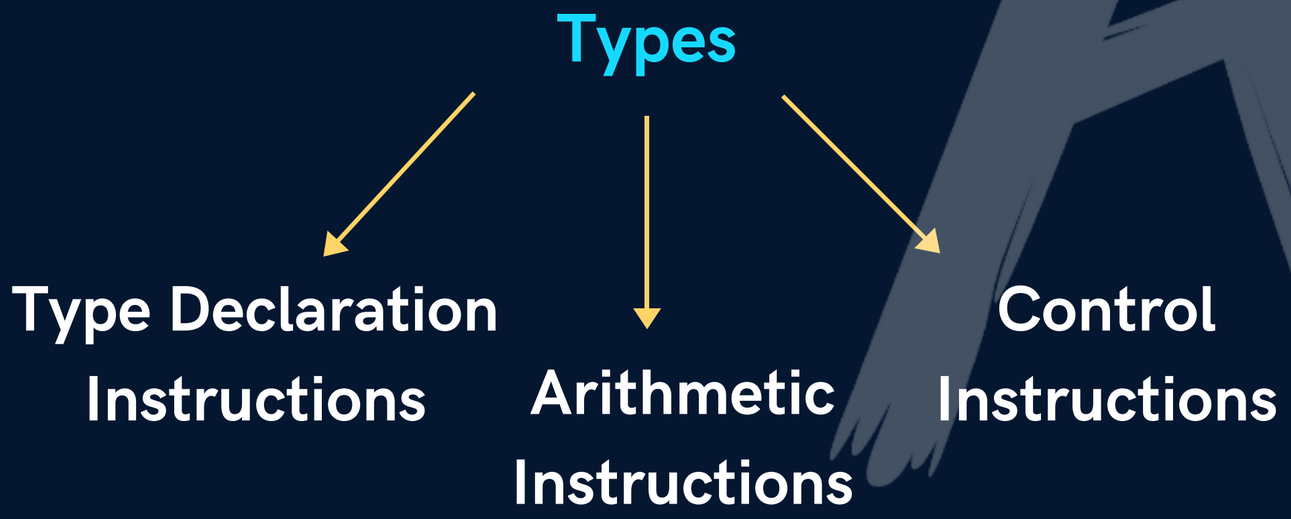
```
#include<stdio.h>
//area of square
int main() {
    int side;
    scanf("%d", &side);
    printf("%d", side * side);
    return 0;
}
```

7. **Practice Qs 2 (Area of Circle)**

```
#include<stdio.h>
//area of square
int main() {
    float radius;
    scanf("%f", &radius);
    printf("%f", 3.14 * radius * radius);
    return 0;
}
```

Instructions

These are statements in a Program



Instructions

Type Declaration Instructions → Declare var before using it

VALID

```
int a = 22;
int b = a;
int c = b + 1;
int d = 1, e;
```

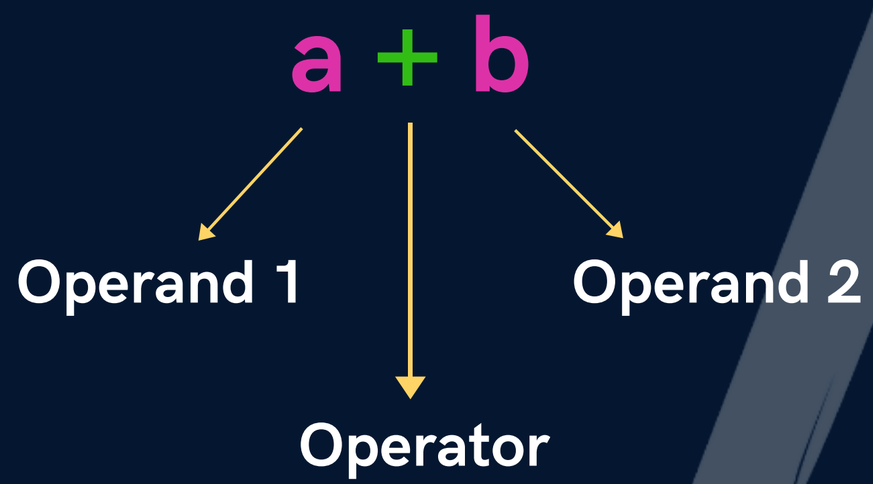
```
int a,b,c;
a = b = c = 1;
```

INVALID

```
int a = 22;
int b = a;
int c = b + 2;
int d = 2, e;
```

```
int a,b,c = 1;
```

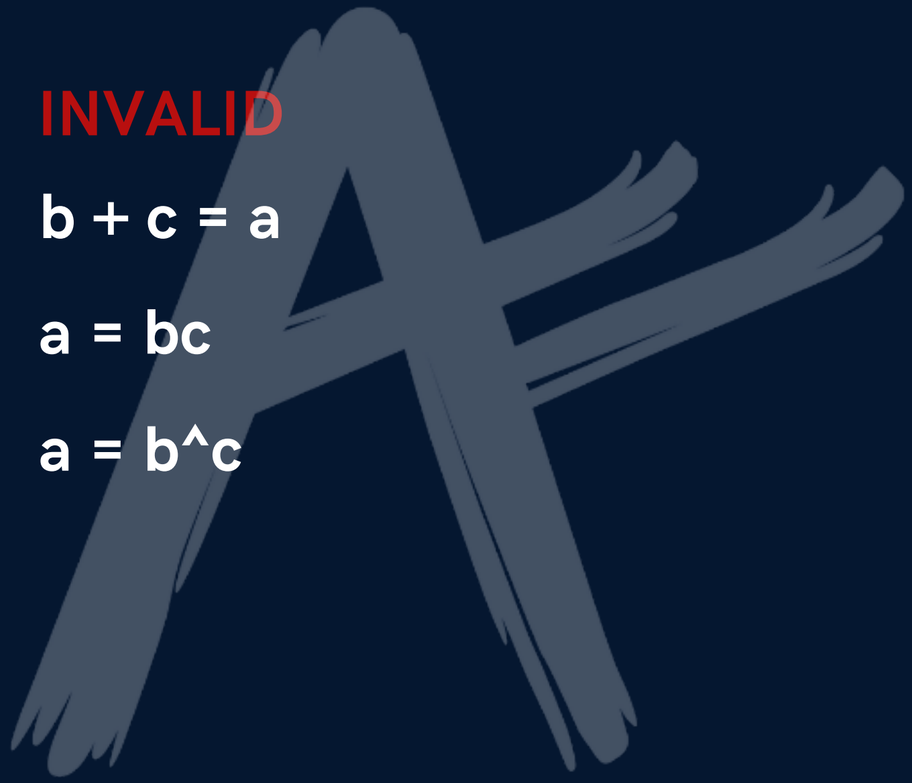
Arithmetic Instructions



NOTE - single variable on the LHS

Arithmetic Instructions

VALID	INVALID
a = b + c	b + c = a
a = b * c	a = bc
a = b / c	a = b^c



NOTE - pow(x,y) for x to the power y

Arithmetic Instructions

Modular Operator %

Returns remainder for int

3 % 2 = 1

-3 % 2 = -1

Arithmetic Instructions

Type Conversion

int op int → int

int op float → float

float op float → float

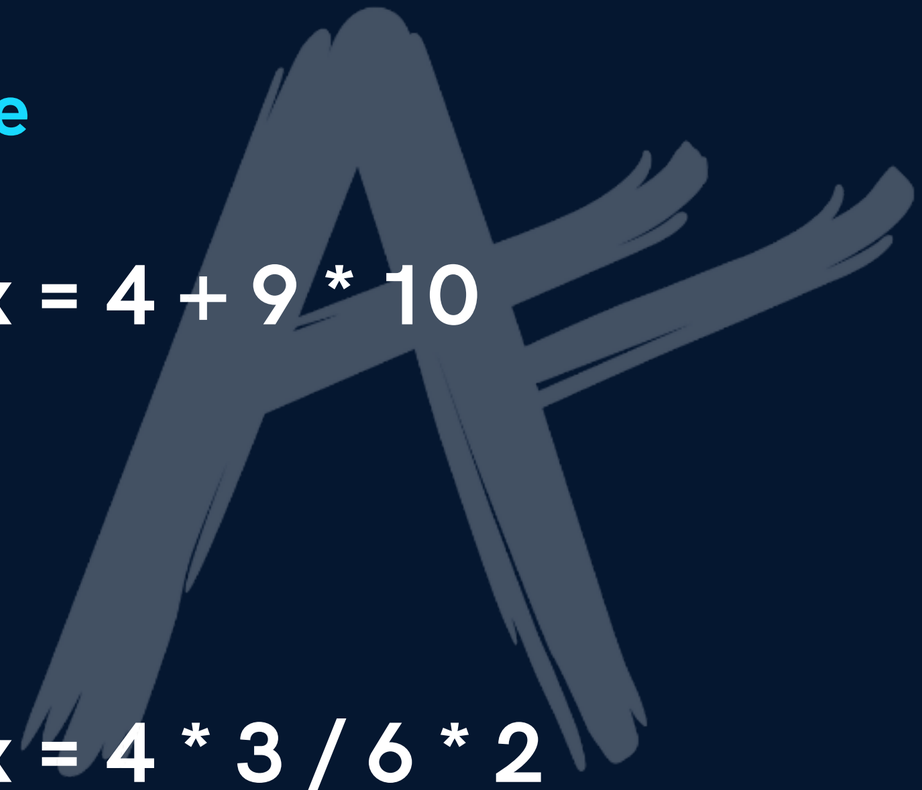
Arithmetic Instructions

Operator Precedence

*, /, %

+, -

=



x = 4 + 9 * 10

x = 4 * 3 / 6 * 2

Arithmetic Instructions

Associativity (for same precedence)

Left to Right

x = 4 * 3 / 6 * 2

Instructions

Control Instructions

Used to determine flow of program

a. Sequence Control

b. Decision Control

c. Loop Control

d. Case Control

Operators

a. Arithmetic Operators

b. Relational Operators

c. Logical Operators

d. Bitwise Operators

e. Assignment Operators

f. Ternary Operator

Operators

Relational Operators

==

>, >=

<, <=

!=

Operators

Logical Operators

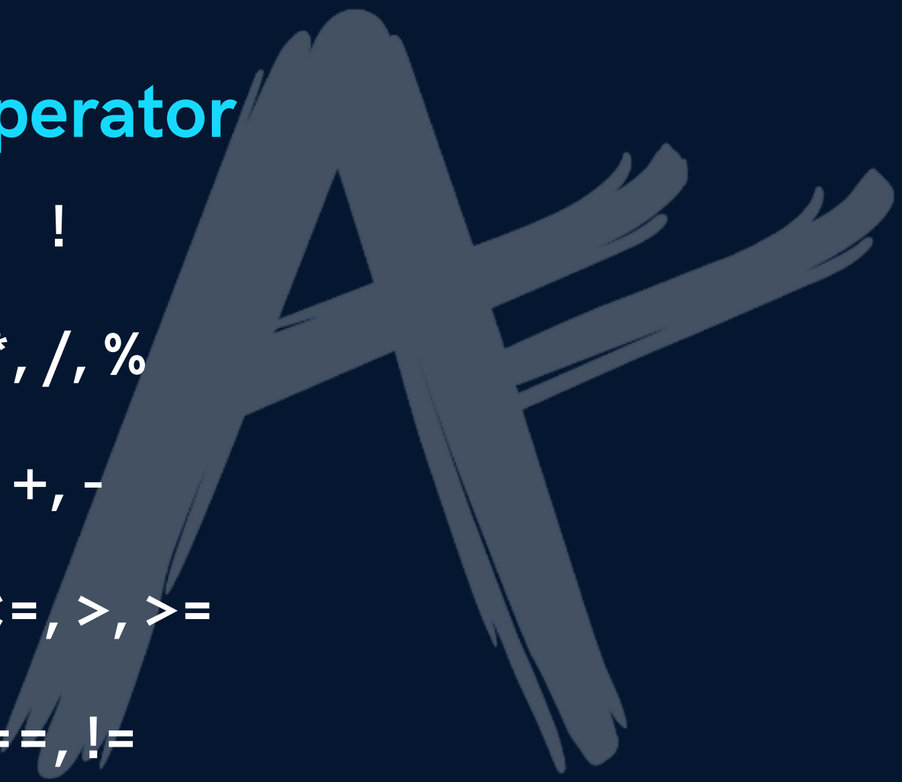
&& AND

|| OR

! NOT

Operator Precendence

Priority	Operator
1	!
2	*, /, %
3	+, -
4	<, <=, >, >=
5	==, !=
6	&&
7	||
8	=



Operators

Assignment Operators

=

+=

-=

*=

/=

%=

C Language Tutorial

(Basic to Advanced)

Topics to be covered :

Installation + Setup
Chapter 1 - Variables, Data types + Input/Output
Chapter 2 - Instructions & Operators
Chapter 3 - Conditional Statements
Chapter 4 - Loop Control Statements
Chapter 5 - Functions & Recursion
Chapter 6 - Pointers
Chapter 7 - Arrays
Chapter 8 - Strings
Chapter 9 - Structures
Chapter 10 - File I/O
Chapter 11 - Dynamic Memory Allocation

Instructions & Operators

(Chapter 2)

1. Type Declaration Instructions

```c
#include<stdio.h>

int main() {
   int age = 22;
   int oldAge = age;
   int newAge = oldAge + 2;
   printf("new age is : %d", newAge);

   int rupee = 1, dollar;
   dollar = 74;

   /*
       order of declaration is important - Wrong Declaration Order
       float pi = 3.14;
       float area = pi * rad * rad;
       float rad = 3;
   */
```

```
    // valid declaration
    int age1, age2, age3;
    age1 = age2 = age3 = 22;

    //invalid
    //int a1 = a2 = a3 = 22;

    return 0;
}
```

2. Arithmetic Instructions

```
#include<stdio.h>

int main() {
    int a = 1, b = 2, c = 3;
    //valid
    a = b + c;

    //invalid
    // b + c = a;

    printf("%d \n", 3 % 2);
    printf("%d \n", -3 % 2);
    return 0;
}
```

> Type Conversion

```
#include<stdio.h>

int main() {
    printf("sum of 2 & 3 : %d", 2 + 3);
    printf("sum of 2.0 & 3 : %f", 2.0 + 3);
    printf("sum of 2.0 & 3.0 : %f", 2.0 + 3.0);
    return 0;
}
```

> Associativity

```
#include<stdio.h>

int main() {
    printf(" Output : %d", 5+2/2*3);
```

```
    return 0;
}
```

3. Relational Operator

```
#include<stdio.h>

int main() {
    printf("%d \n", 4==4);

    printf("%d \n", 4<3);
    printf("%d \n", 3<4);
    printf("%d \n", 4<4);
    printf("%d \n", 4<=4);

    printf("%d \n", 4>3);
    printf("%d \n", 3>4);
    printf("%d \n", 4>4);
    printf("%d \n", 4>=4);

    printf("%d \n", 4!=4);
    printf("%d \n", 3!=4);
    return 0;
}
```

4. Logical Operator

```
#include<stdio.h>

int main() {
    printf("%d \n", 3<4 && 3<5);
    printf("%d \n", 3<4 && 5<4);

    printf("%d \n", 3<4 && 5<4);
    printf("%d \n", 3>4 && 5>4);
    printf("%d \n", 3<4 && 3<5);

    printf("%d \n", !(3<4 && 3<5));
    printf("%d \n", !(4<3 || 5<3));
    return 0;
}
```

5. Assignment Operator

```c
# include <stdio.h>

int main() {
   int a = 10;
   a += 10;
   printf("a+10 = %d \n", a);
   a -= 10;
   printf("a-10 = %d \n", a);
   a *= 10;
   printf("a*10 = %d \n", a);
   a /= 10;
   printf("a/10 = %d \n", a);
   a %= 10;
   printf("a%c10 = %d \n", '%', a);
   return 0;
}
```

Conditional Statements

Types

- if-else
- Switch

if-else

```
if(Condition) {
    //do something if TRUE
}
else {
    //do something if FALSE
}
```

Ele is optional block

can also work without {}

else if

```
if(Condition 1) {
    //do something if TRUE
}
else if (Condition 2) {
    //do something if 1st is FALSE & 2nd is TRUE
}
```

Conditional Operators

Ternary

Condition ? doSomething if TRUE : doSomething if FALSE;

give 1 & 0 cases

Conditional Operators

switch

```
switch(number) {
case  C1: //do something
          break;
case C2 : //do something
          break;
default : //do something
}
```

Conditional Operators

switch Properties

a. Cases can be in any order

b. Nested switch (switch inside switch) are allowed

C Language Tutorial

(Basic to Advanced)

Topics to be covered :

Conditional Statements

(Chapter 3)

1. **If-else**

```c
#include<stdio.h>

int main() {
   int age = 19;
   if(age >= 18) {
       printf("you are an adult");
   }
   else {
       printf("you are not an adult");
   }
   return 0;
}
```

> check if a number is odd or even

```c
#include<stdio.h>

int main() {
   int number;
```

```
    scanf("%d", &number);

    if(number % 2 == 0) {
        printf("even");
    }
    else {
        printf("odd");
    }
    return 0;
}
```

> Use of else if

```
#include<stdio.h>

int main() {
    int age;
    printf("Enter age : ");
    scanf("%d", &age);

    if(age < 12) {
        printf("child");
    }
    else if(age < 18) {
        printf("teenager");
    }
    else {
        printf("adult");
    }
    return 0;
}
```

2. Ternary Operator

```
#include<stdio.h>

int main() {
    int age;
    printf("Enter age : ");
    scanf("%d", &age);

    age > 18 ? printf("adult \n") : printf("not adult \n");

    int number = 7;
```

```
    int luckyNumber = 7;

    number == luckyNumber ? printf("you are lucky \n") : printf("you are not
lucky \n");

    return 0;
}
```

3. **Switch (integer)**

```
#include<stdio.h>
#include<math.h>

int main() {
    int day = 5;
    switch(day) {
        case 1 : printf("monday \n");
                 break;
        case 2 : printf("tuesday \n");
                 break;
        case 3 : printf("wednesday \n");
                 break;
        case 4 : printf("thursday \n");
                 break;
        case 5 : printf("friday \n");
                 break;
        case 6 : printf("saturday \n");
                 break;
        case 7 : printf("sunday \n");
                 break;
    }
    return 0;
}
```

4. **Switch (character)**

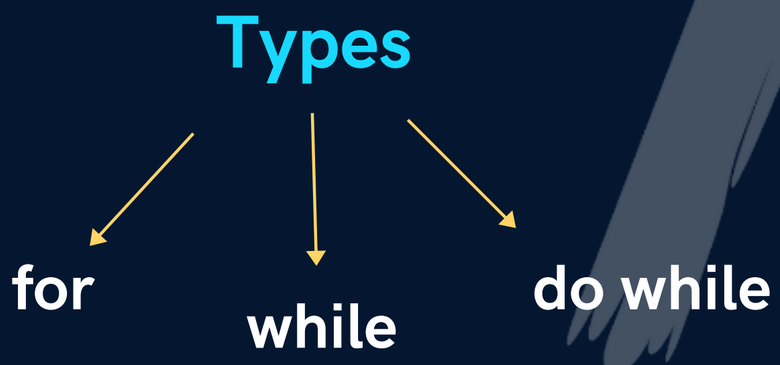
```
#include<stdio.h>
#include<math.h>

int main() {
    char day = 'f';
    switch(day) {
        case 'm' : printf("monday \n");
                 break;
```

```
        case 't' : printf("tuesday \n");
                   break;
        case 'w' : printf("wednesday \n");
                   break;
        case 'T' : printf("thursday \n");
                   break;
        case 'f' : printf("friday \n");
                   break;
        case 's' : printf("saturday \n");
                   break;
        case 'S' : printf("sunday \n");
                   break;
    }
    return 0;
}
```

Loop Control Instructions

To repeat some parts of the program



for Loop

```
for(initialisation; condition; updation) {

//do something

}
```

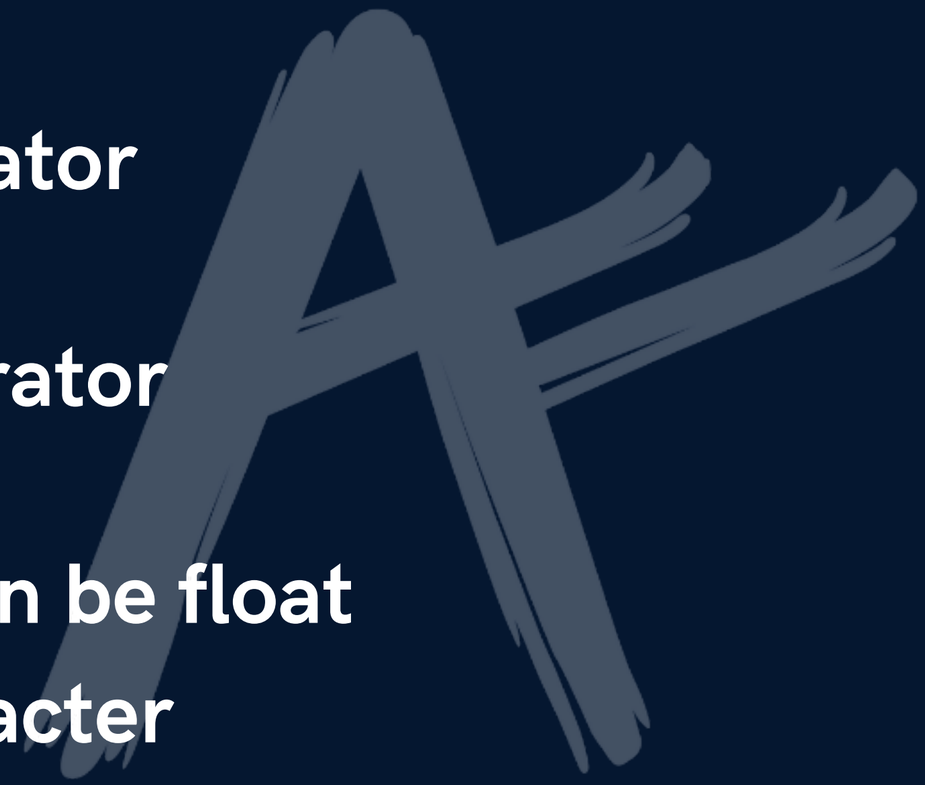
Special Things

- Increment Operator

- Decrement Operator

- Loop counter can be float
  or even character

- Infinite Loop



while Loop

```
while(condition) {

//do something

}
```

```
while (true)
{
}
```

```
for (; ;){
}
```

do while Loop

```
do {

//do something

} while(condition);
```

break Statement

exit the loop

continue Statement

skip to next iteration

Nested Loops

```
for( .. ) {
    for( .. ) {


    }
}
```

C Language Tutorial

(Basic to Advanced)

Topics to be covered :

Installation + Setup
Chapter 1 - Variables, Data types + Input/Output
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Loop Control Statements

(Chapter 4)

1. **Syntax of 3 Loops**

```c
# include <stdio.h>

int main () {
   //for loop
   for(int i=1; i<=100; i++) {
       printf("%d\n", i);
   }

   //while loop
   int i=1;
   while(i<=100) {
       printf("%d\n", i);
       i++;
   }

   //do while loop
   i = 1;
   do {
```

```
        printf("%d\n", i);
        i++;
    } while(i<=100);

    return 0;
}
```

Functions

↓

block of code that performs particular task

it can be used multiple times

increase code reusability

Syntax 1

Function Prototype

```
void printHello( );
```

> Tell the compiler

Syntax 2

Function Definition

```
void printHello() {
    printf("Hello");
}
```

> Do the Work

Syntax 3

Function Call

```
int main() {
    printHello( );
    return 0;
}
```

> Use the Work

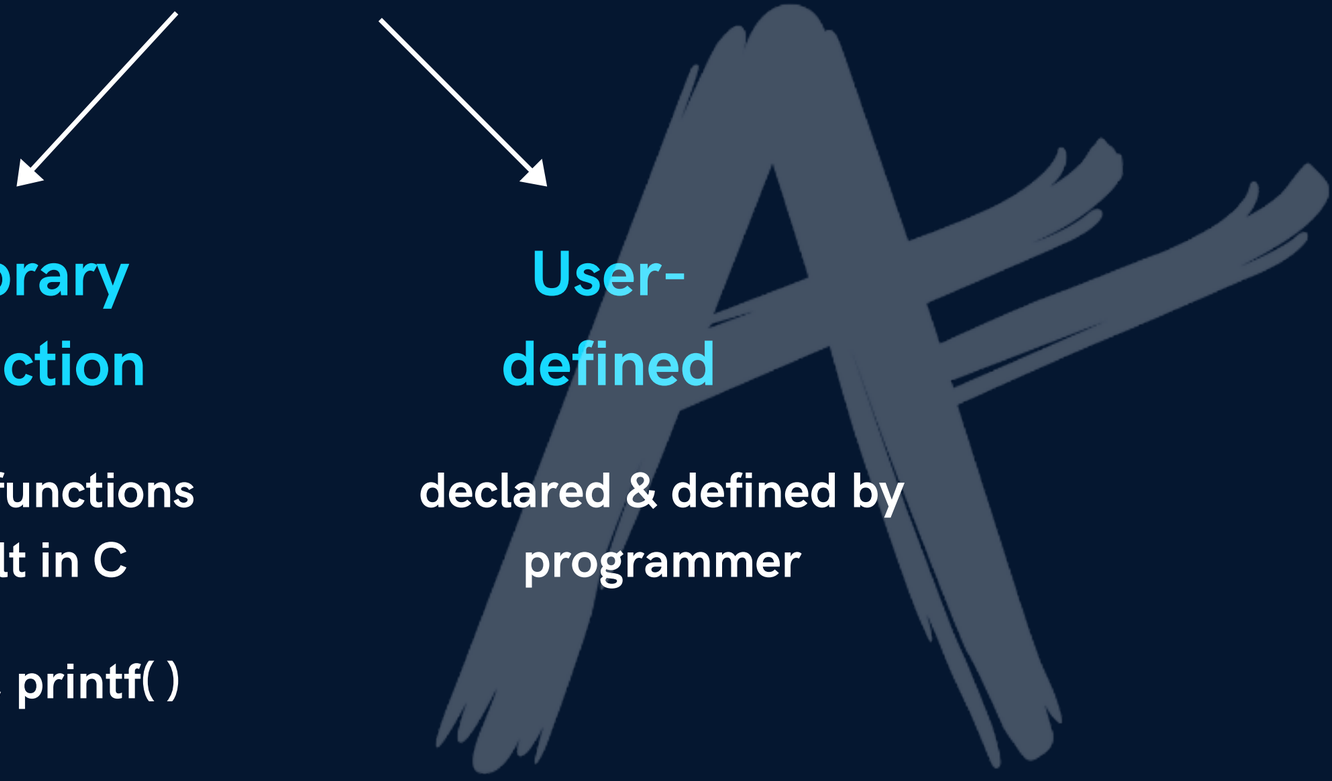
Properties

- Execution always starts from main

- A function gets called directly or indirectly from main

- There can be multiple functions in a program

Function Types



Library function

Special functions inbuilt in C

scanf( ), printf( )

User-defined

declared & defined by programmer

Passing Arguments

functions can take value & give some value

parameter

return value

Passing Arguments

```
void printHello( );
```

```
void printTable(int n);
```

```
int sum(int a, int b);
```

Passing Arguments

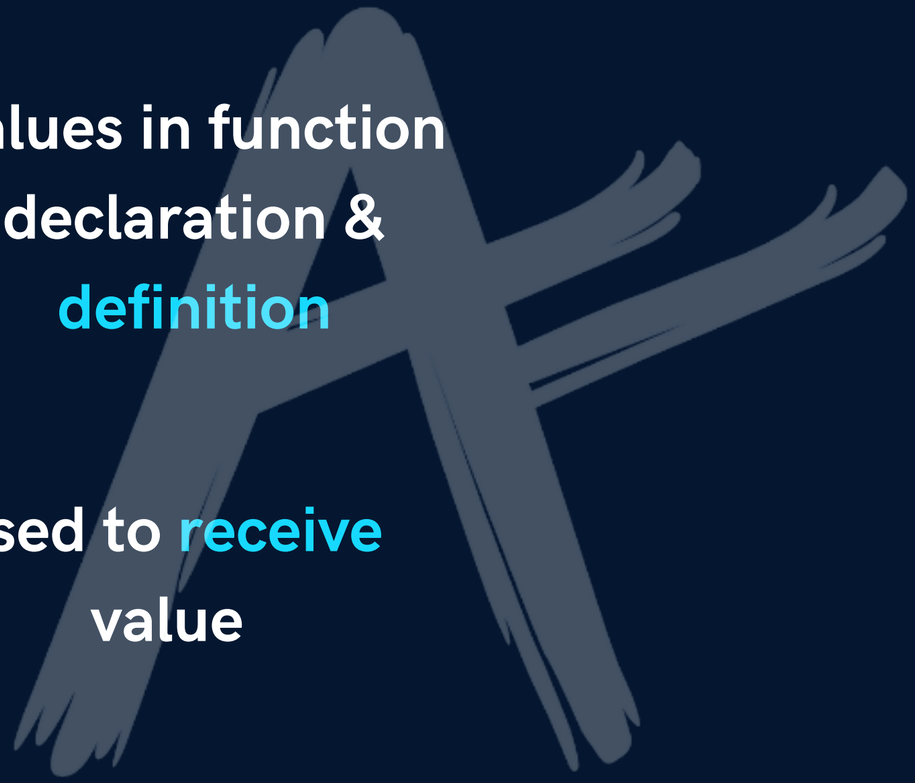
functions can take value & give some value

parameter

return value

Argument v/s Parameter

values that are passed in function call	values in function declaration & definition
used to send value	used to receive value
actual parameter	formal parameters

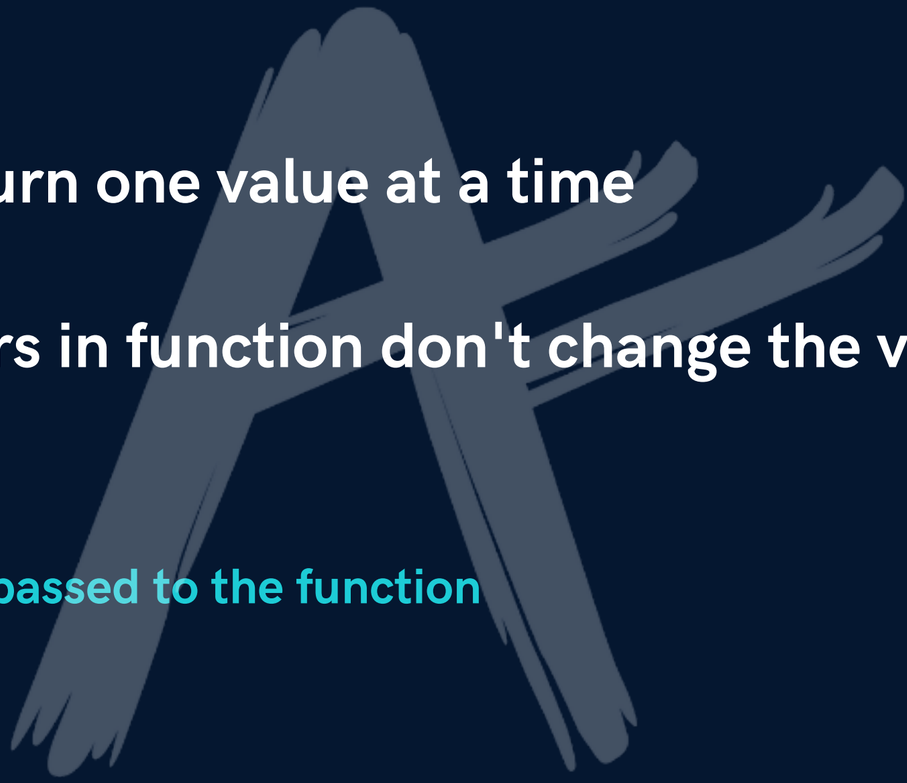


NOTE

a. Function can only return one value at a time

b. Changes to parameters in function don't change the values in calling function.

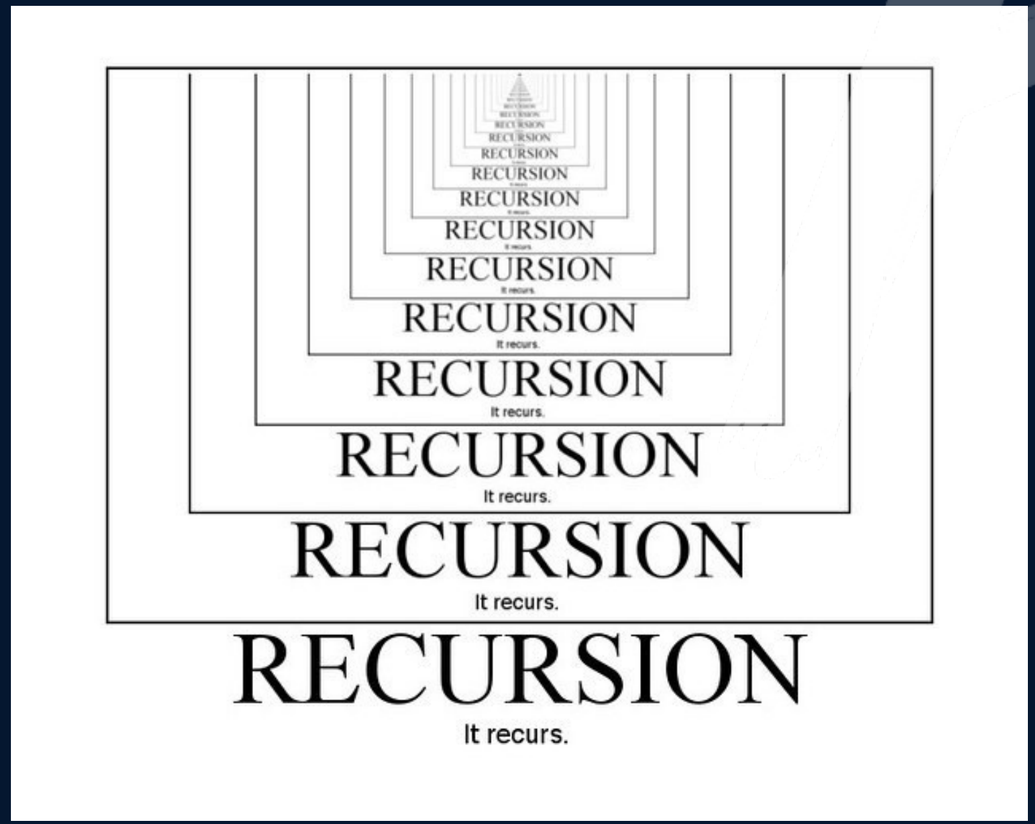
Because a copy of argument is passed to the function



Recursion

↓

When a function calls itself, it's called recursion



Properties of Recursion

a. Anything that can be done with Iteration, can be done with recursion and vice-versa.

b. Recursion can sometimes give the most simple solution.

c. Base Case is the condition which stops recursion.

d. Iteration has infinite loop & Recursion has stack overflow

C Language Tutorial

(Basic to Advanced)

Topics to be covered :

Functions & Recursion

(Chapter 5)

1. **Function to print Hello**

```c
#include<stdio.h>

//function declaration/prototype
void printHello();

int main() {
   //function call
   printHello();
   return 0;
}

//function definition
void printHello() {
   printf("Hello!\n");
}
```

2. **Function to calculate square of a number**

```c
# include <stdio.h>
//function to calculate square of a number
int calcSquare(int n);

int main() {
   int n;
   printf("enter n : ");
   scanf("%d", &n);
   printf("square is : %d", calcSquare(n));
   return 0;
}

int calcSquare(int n) {
   return n * n;
}
```

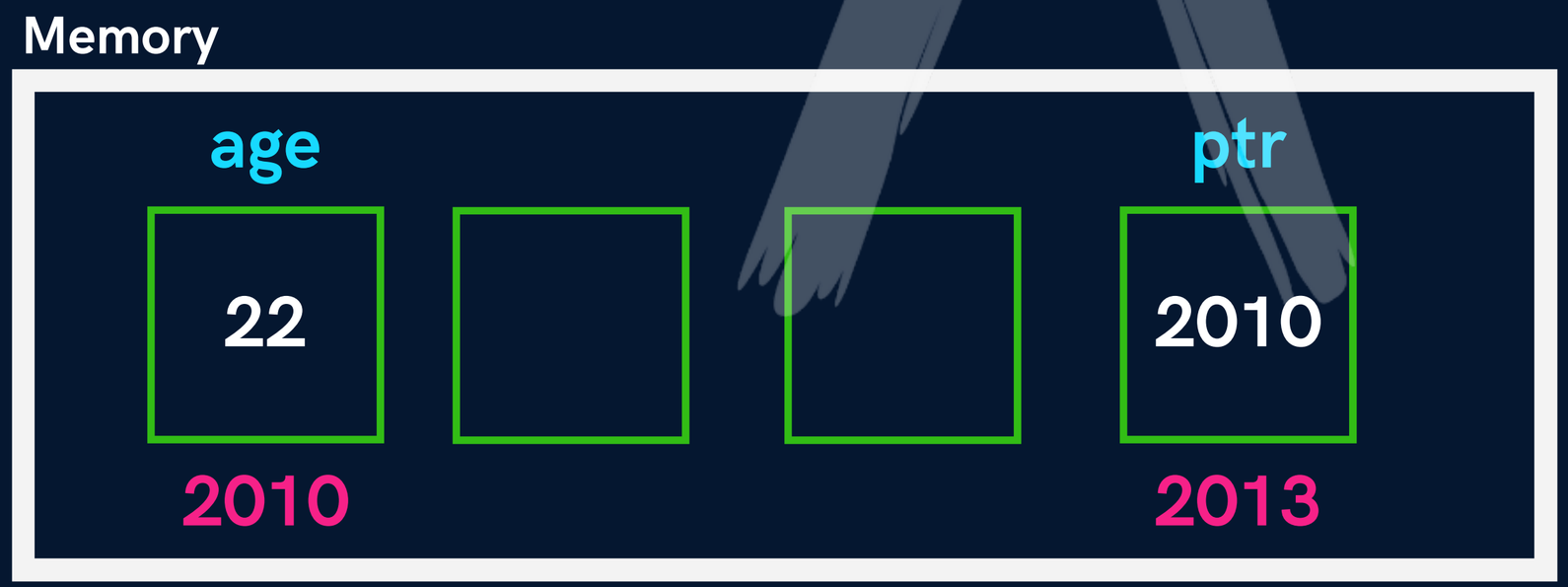
3. **Function to calculate n factorial (using recursion)**

```c
# include <stdio.h>
//function to print factorial of n
int factorial(int n);

int main() {
   int n;
   printf("enter n : ");
   scanf("%d", &n);
   printf("factorial is : %d", factorial(n));
   return 0;
}

int factorial(int n) {
   if(n == 0) {
       return 1;
   }
   int factnm1 = factorial(n-1);
   int factn = factnm1 * n;
   return factn;
}
```

Pointers

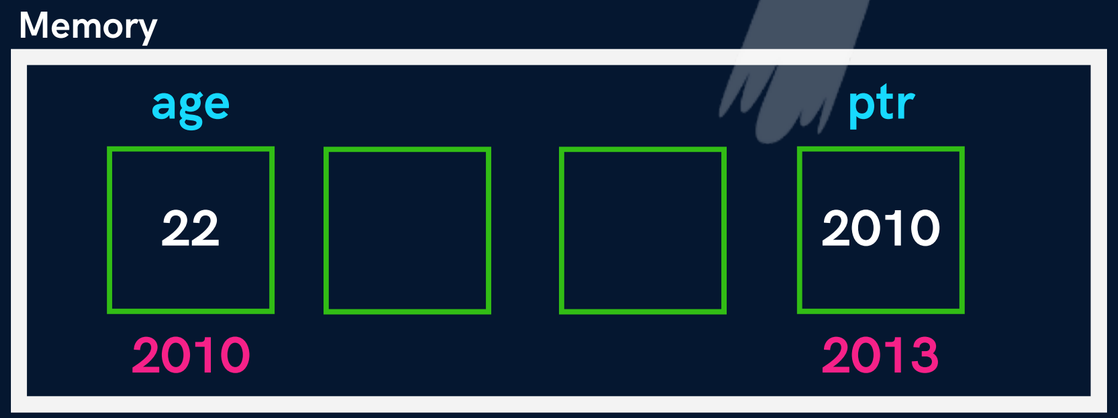
↓

A variable that stores the memory address of another variable



Syntax

```
int age = 22;

int *ptr = &age;

int _age = *ptr;
```



Declaring Pointers

```
int *ptr;

char *ptr;

float *ptr;
```

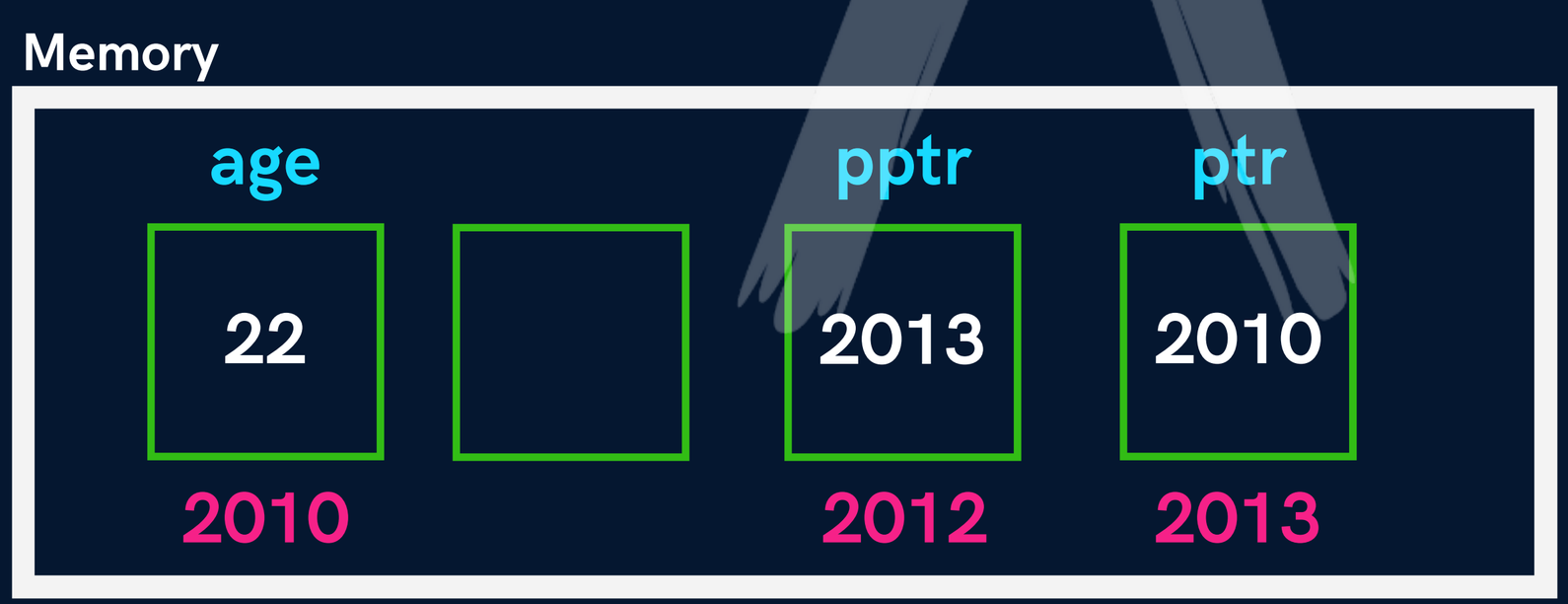
Format Specifier

```
printf("%p", &age);

printf("%p", ptr);

printf("%p", &ptr);
```

Pointer to Pointer

↓

A variable that stores the memory address of another pointer



Pointer to Pointer

Syntax

```
int **pptr;

char **pptr;

float **pptr;
```

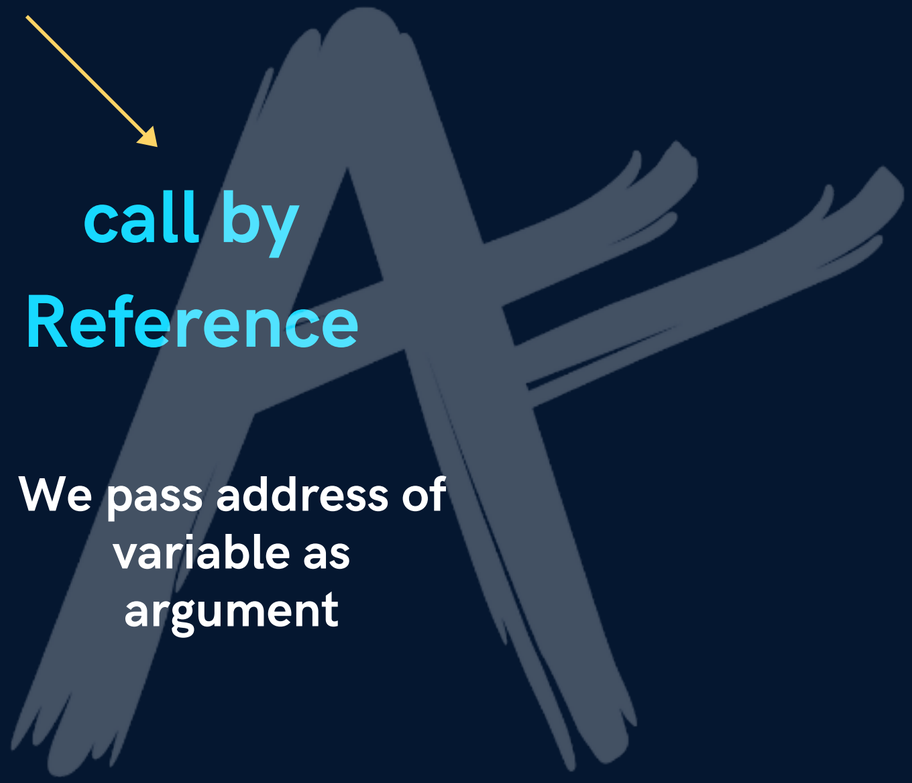
Pointers in Function Call

Call by Value

We pass value of variable as argument

call by Reference

We pass address of variable as argument



APNA COLLEGE

C Language Tutorial

(Basic to Advanced)

Topics to be covered :

Installation + Setup
Chapter 1 - Variables, Data types + Input/Output
Chapter 2 - Instructions & Operators
Chapter 3 - Conditional Statements
Chapter 4 - Loop Control Statements
Chapter 5 - Functions & Recursion
Chapter 6 - Pointers
Chapter 7 - Arrays
Chapter 8 - Strings
Chapter 9 - Structures
Chapter 10 - File I/O
Chapter 11 - Dynamic Memory Allocation

Pointers

(Chapter 6)

1. **Syntax**

```c
#include<stdio.h>

int main() {
   int age = 22;
   int *ptr = &age;
   int _age = *ptr;
   printf("%d\n", _age);

   //address
   printf("%p\n", &age);
   printf("%p\n", ptr);
   printf("%p\n", &ptr);

   //data
   printf("%d\n", age);
   printf("%d\n", *ptr);
   printf("%d\n", *(&age));
   return 0;
```

```
}
```

2. Pointers in Function call

```c
# include <stdio.h>

void square(int n);
void _square(int* n);

int main() {
   int number = 4;

   //call by value
   square(number);
   printf("n is : %d\n", number);

   //call by reference
   _square(&number);
   printf("n is : %d\n", number);
   return 0;
}

void square(int n) {
   n = n * n;
   printf("square is : %d\n", n);
}

void _square(int* n) {
   *n = *n * *n;
   printf("square is : %d\n", *n);
}
```

3. Swap 2 numbers

```c
# include <stdio.h>

void swap(int a, int b);
void _swap(int* a, int *b);

int main() {
   int x = 3, y = 5;

   //call by value
   swap(x, y);
```

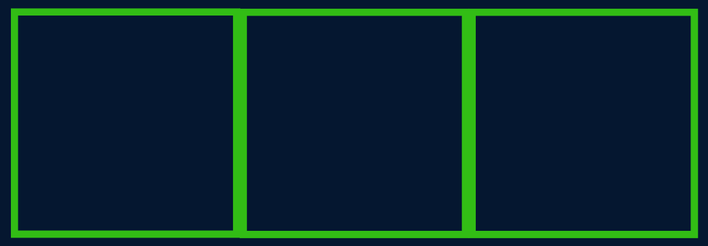
```
    printf("x = %d & y = %d\n", x, y);

    //call by reference
    _swap(&x, &y);
    printf("x = %d & y = %d\n", x, y);
    return 0;
}

void swap(int a, int b) {
    int t = a;
    a = b;
    b = a;
}

void _swap(int* a, int* b) {
    int t = *a;
    *a = *b;
    *b = *a;
}
```

Arrays

Collection of similar data types stored at contiguous memory locations

Syntax

```
int marks[3];

char name[10];

float price[2];
```



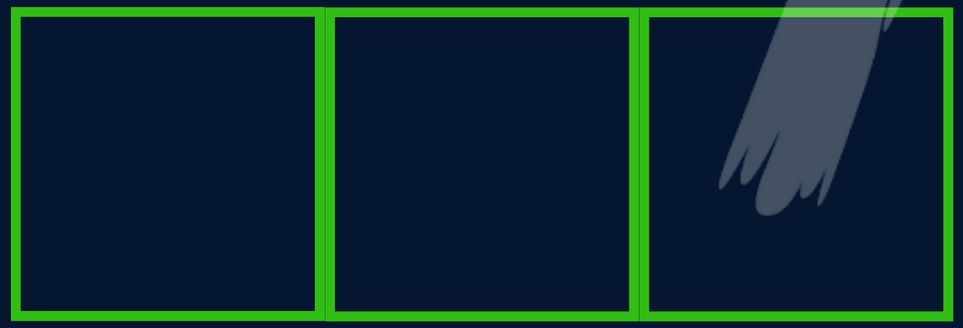
Input & Output

```
scanf("%d", &marks[0]);
```

```
printf("%d", marks[0]);
```

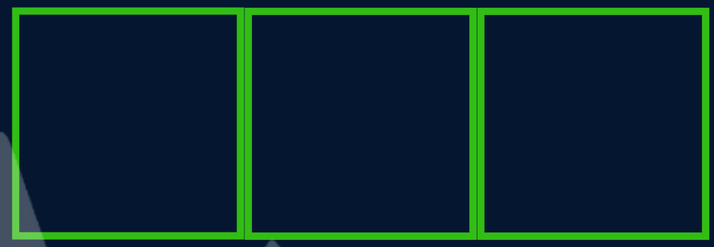
Inititalization of Array

```
int marks[ ] = {97, 98, 89};

int marks[ 3 ] = {97, 98, 89};
```



Memory Reserved :

Pointer Arithmetic

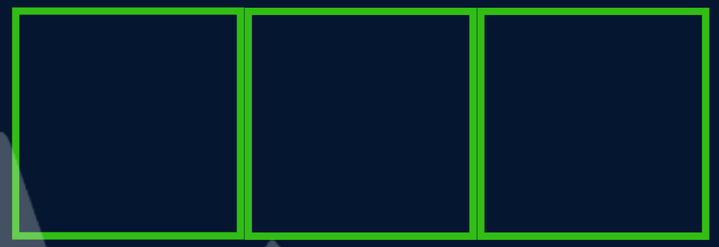


Pointer can be incremented
& decremented

CASE 1

```
int age = 22;
int *ptr = &age;
ptr++;
```

Pointer Arithmetic



CASE 2

```
float price = 20.00;
float *ptr = &price;
ptr++;
```

CASE 3

```
char star = '*';
char *ptr = &star;
ptr++;
```

Pointer Arithmetic

- We can also subtract one pointer from another

- We can also compare 2 pointers

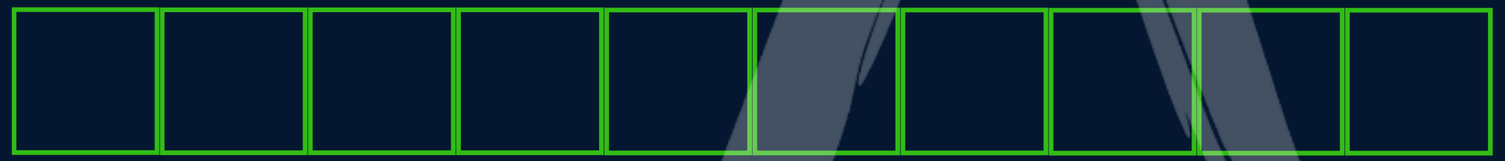
Array is a Pointer

```
int *ptr = &arr[0];
```

```
int *ptr = arr;
```

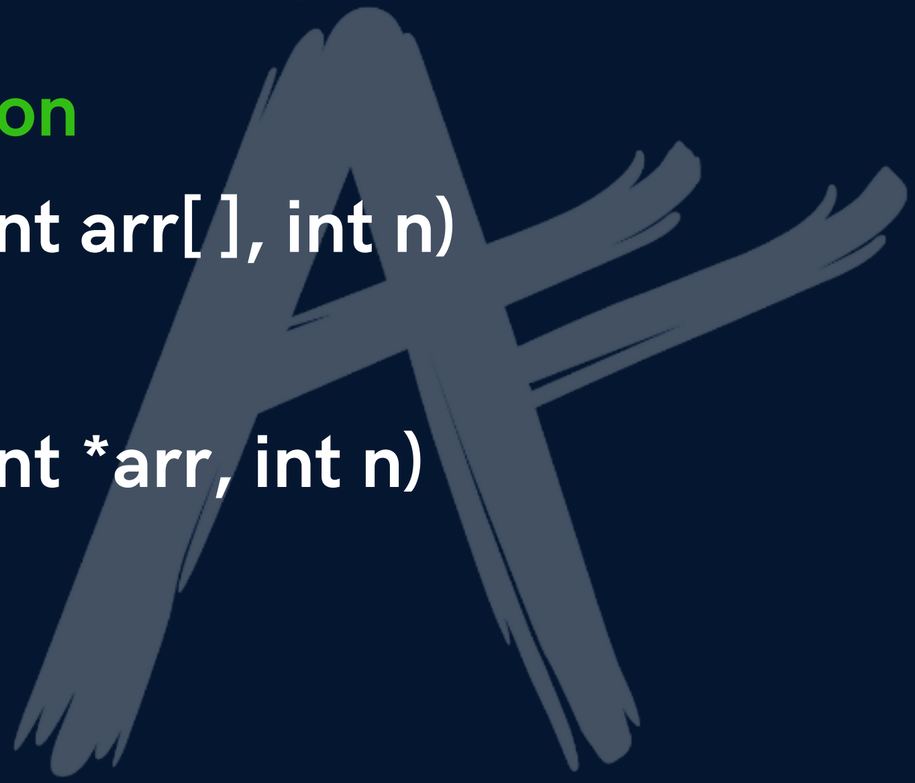
Traverse an Array

```
int aadhar[10];

int *ptr = &aadhar[0];
```



Arrays as Function Argument

```
//Function Declaration
void printNumbers (int arr[ ], int n)
                    OR
void printNumbers (int *arr, int n)


//Function Call
printNumbers(arr, n);
```



Multidimensional Arrays

2 D Arrays

```
int arr[ ][ ] = { {1, 2}, {3, 4} };    //Declare


//Access
arr[0][0]
arr[0][1]
arr[1][0]
arr[1][1]
```

APNA COLLEGE

C Language Tutorial

(Basic to Advanced)

Topics to be covered :

Arrays

(Chapter 7)

1. **Syntax**

```c
# include <stdio.h>

int main() {
   int marks[3];
   printf("physics : ");
   scanf("%d", &marks[0]);

   printf("chem : ");
   scanf("%d", &marks[1]);

   printf("math : ");
   scanf("%d", &marks[2]);

   printf("physics = %d, ", marks[0]); //physics
   printf("chem = %d, ", marks[1]);  //chem
   printf("math = %d \n", marks[2]); //math
```

```
    return 0;
}
```

2. **Pointer Arithmetic**

```c
# include <stdio.h>

int main() {

    int age = 22;
    int *ptr = &age;

    int _age = 25;
    int *_ptr = &_age;

    printf("%u\n", ptr);
    ptr++;
    printf("%u\n", ptr);
    ptr--;
    printf("%u\n", ptr);
    ptr = ptr - _ptr;
    printf("%u\n", ptr);

    ptr = &_age;
    printf("%d\n", ptr == _ptr);

    return 0;
}
```

3. **Accessing an Array**

```c
# include <stdio.h>

void printNumbers(int *arr, int n);
void _printNumbers(int arr[], int n);

int main() {
    int arr[] = {1, 2, 3, 4, 5, 6};
    printNumbers(arr, 6);
    printNumbers(arr, 6);
    return 0;
}
```

```c
void printNumbers(int *arr, int n) {
    for(int i=0; i<n; i++) {
        printf("%d : %d\n", i, arr[i]);
    }
}

void _printNumbers(int arr[], int n) {
    for(int i=0; i<n; i++) {
        printf("%d : %d\n", i, arr[i]);
    }
}
```

Strings

A character array terminated by a '\0' (null character)

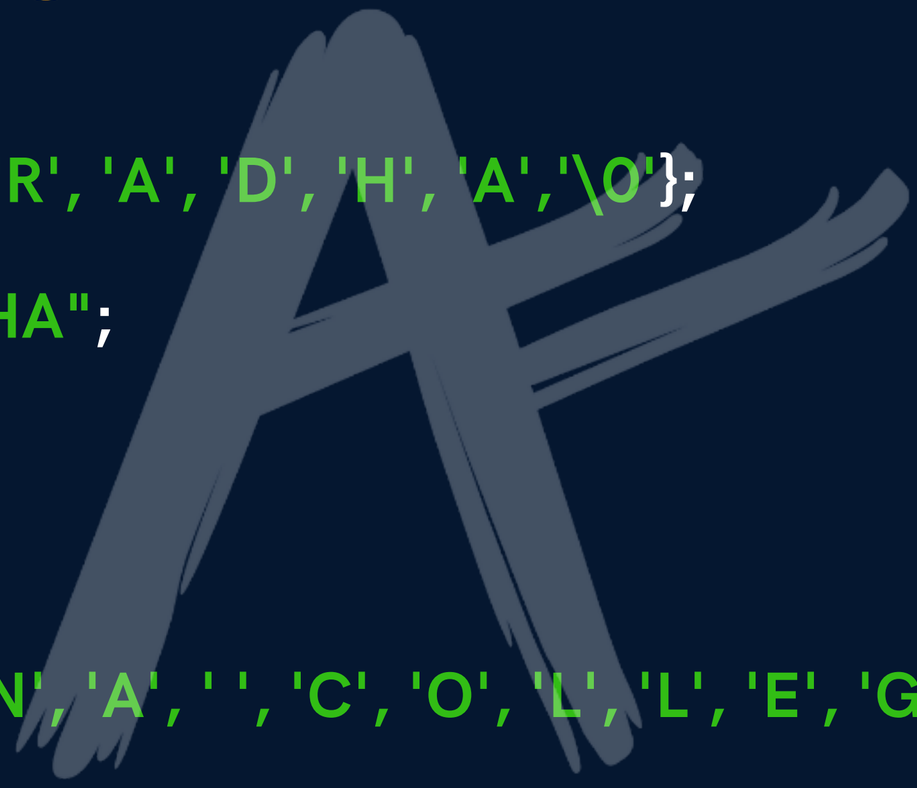
null character denotes string termination

EXAMPLE

```
char name[ ] = {'S', 'H', 'R', 'A', 'D', 'H', 'A', '\0'};

char class[ ] = {'A', 'P', 'N', 'A', ' ', 'C', 'O', 'L', 'L', 'E', 'G', 'E', '\0'};
```

Initialising Strings

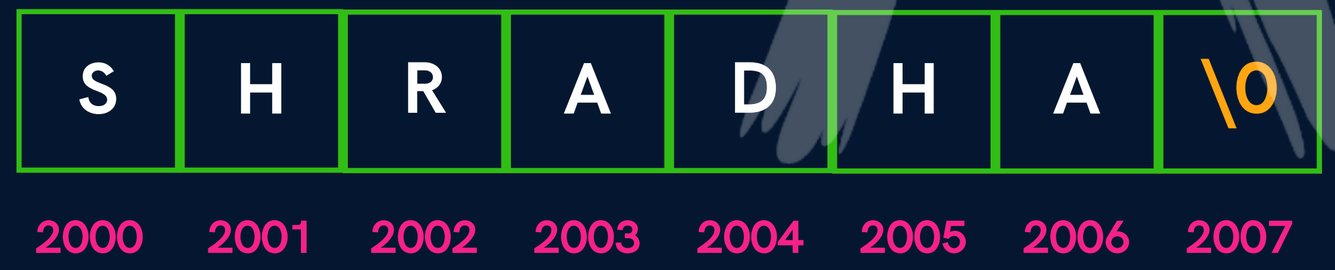
```
char name[ ] = {'S', 'H', 'R', 'A', 'D', 'H', 'A','\0'};

char name[ ] = "SHRADHA";
```



```
char class[ ] = {'A', 'P', 'N', 'A', ' ', 'C', 'O', 'L', 'L', 'E', 'G', 'E', '\0'};

char class[ ] = "APNA COLLEGE";
```

What Happens in Memory?

```
char name[ ] = {'S', 'H', 'R', 'A', 'D', 'H', 'A','\0'};

char name[ ] = "SHRADHA";
```



String Format Specifier

↓

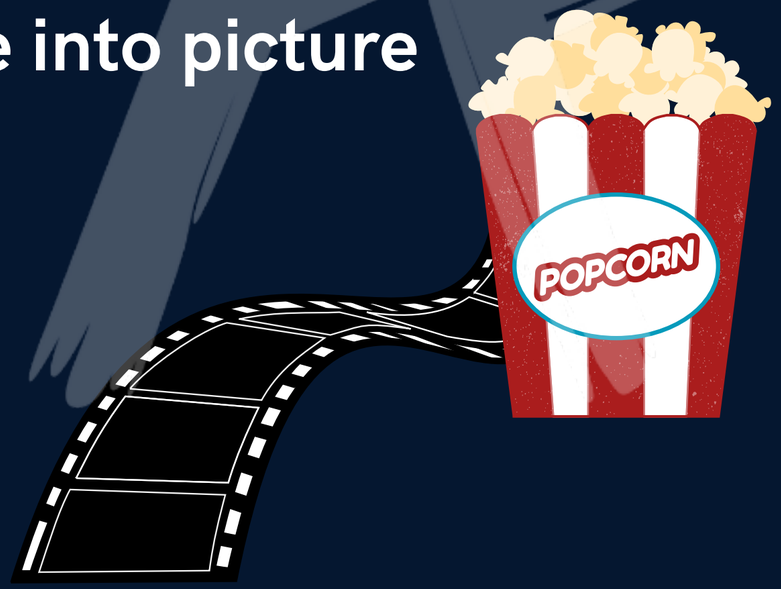
"%s"

```
char name[ ] = "Shradha";

printf("%s", name);
```

IMPORTANT

scanf( ) cannot input multi-word strings with spaces

Here,
gets( ) & puts( ) come into picture



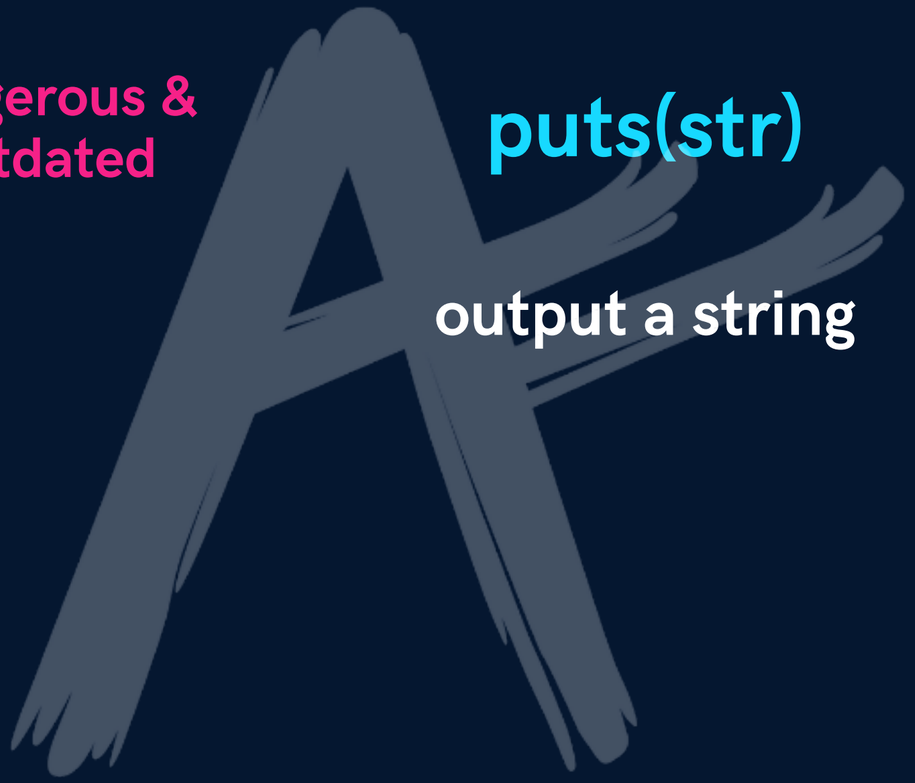
String Functions

gets(str) ⟶ Dangerous & Outdated

input a string
(even multiword)

puts(str)

output a string



fgets(str, n, file)

stops when n-1
chars input or new
line is entered

String using Pointers

```
char *str = "Hello World";
```

Store string in memory & the assigned address is stored in the char pointer 'str'

```
char *str = "Hello World";    //can be reinitialized
```

```
char str[ ] = "Hello World";
//cannot be reinitialized
```

Standard Library Functions

↓

<string.h>

1 strlen(str)

count number of characters excluding '\0'

Standard Library Functions

↓

<string.h>

2 strcpy(newStr, oldStr)

copies value of old string to new string

Standard Library Functions

↓

<string.h>

3 strcat(firstStr, secStr)

concatenates first string with second string

firstStr should be large enough

Standard Library Functions

↓

<string.h>

4 strcpm(firstStr, secStr)

Compares 2 strings & returns a value

0 -> string equal

positive -> first > second (ASCII)

negative -> first < second (ASCII)

C Language Tutorial

(Basic to Advanced)

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Installation + Setup
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Chapter 9 - Structures
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Chapter 11 - Dynamic Memory Allocation

Strings

(Chapter 8)

1. Strings

```c
# include <stdio.h>
# include <string.h>



int main() {
   //declaration
   char name[] = "Shradha Khapra";
   char course[] = {'a','p', 'n', 'a', ' ', 'c', 'o', 'l', 'l', 'e', 'g', 'e',
'\0'};

   //printing string
   for(int i=0; name[i] != '\0'; i++) {
      printf("%c", name[i]);
   }
   printf("\n");

   //printing string with pointer
   for(char *ptr=name; *ptr != '\0'; ptr++) {
      printf("%c", *ptr);
```

```
}
printf("\n");

//printing using format specifier
printf("%s\n", name);

//input a string
char firstName[40];
printf("enter first name : ");
scanf("%s", firstName);
printf("you first name is %s\n", firstName);
 char fullName[40];
printf("enter full name : ");
scanf("%s", fullName);
printf("you first name is %s\n", fullName);

// gets & puts
char fullName[40];
printf("enter full name : ");
fgets(fullName, 40, stdin);
puts(fullName);

//Library Functions
char name[] = "Shradha";
int length = strlen(name);
printf("the length of name : %d\n", length);

char oldVal[] = "oldValue";
char newVal[50];
strcpy(newVal, oldVal);
puts(newVal);

char firstStr[50] = "Hello ";
char secStr[] = "World";
strcat(firstStr, secStr);
puts(firstStr);

char str1[] = "Apple";
char str2[] = "Banana";
printf("%d\n", strcmp(str1, str2));

//enter String using %c
```

```
    printf("enter string : ");
    char str[100];
    char ch;
    int i = 0;

    while(ch != '\n') {
        scanf("%c", &ch);
        str[i] = ch;
        i++;
    }
    str[i] = '\0';
    puts(str);

    return 0;
}
```

> Some more Qs

```
# include <stdio.h>
# include <string.h>

// void printString(char arr[]);
// int countLength(char arr[]);
// void salting(char password[]);
// void slice(char str[], int n, int m);

//int countVowels(char str[]);

void checkChar(char str[], char ch);

int main() {
    char str[] = "ApnaCollege";
    char ch = 'x';
    checkChar(str, ch);
}

void checkChar(char str[], char ch) {
    for(int i=0; str[i] != '\0'; i++) {
        if(str[i] == ch) {
            printf("character is present!");
            return;
```

```
        }
    }
     printf("character is NOT present:(");
}




// int countVowels(char str[]) {
//     int count = 0;

//     for(int i=0; str[i] != '\0'; i++) {
//         if(str[i] == 'a' || str[i] == 'e' || str[i] == 'i' ||
//            str[i] == 'o' || str[i] == 'u') {
//                count++;
//            }
//     }
//     return count;
// }




// void slice(char str[], int n, int m) { // n & m are valid value
//     char newStr[100];
//     int j = 0;
//     for(int i=n; i<=m; i++, j++) {
//         newStr[j] = str[i];
//     }
//     newStr[j] = '\0';
//     puts(newStr);
// }



// void salting(char password[]) {
//     char salt[] = "123";
//     char newPass[200];

//     strcpy(newPass, password); // newPass = "test"
//     strcat(newPass, salt); // newPass = "test" + "123";
//     puts(newPass);
```

```
// }



// int countLength(char arr[]) {
//     int count = 0;
//     for(int i=0; arr[i]!='\0'; i++) {
//         count++;
//     }
//     return count-1;
// }

// void printString(char arr[]) {
//     for(int i=0; arr[i] != '\0' ;i++) {
//         printf("%c", arr[i]);
//     }
//     printf("\n");
// }
```

Structures

↓

a collection of values of different data types

EXAMPLE

For a student store the following :

- name (String)
- roll no (Integer)
- cgpa (Float)

Syntax

```
struct student {
    char name[100];
    int roll;
    float cgpa;
};
```

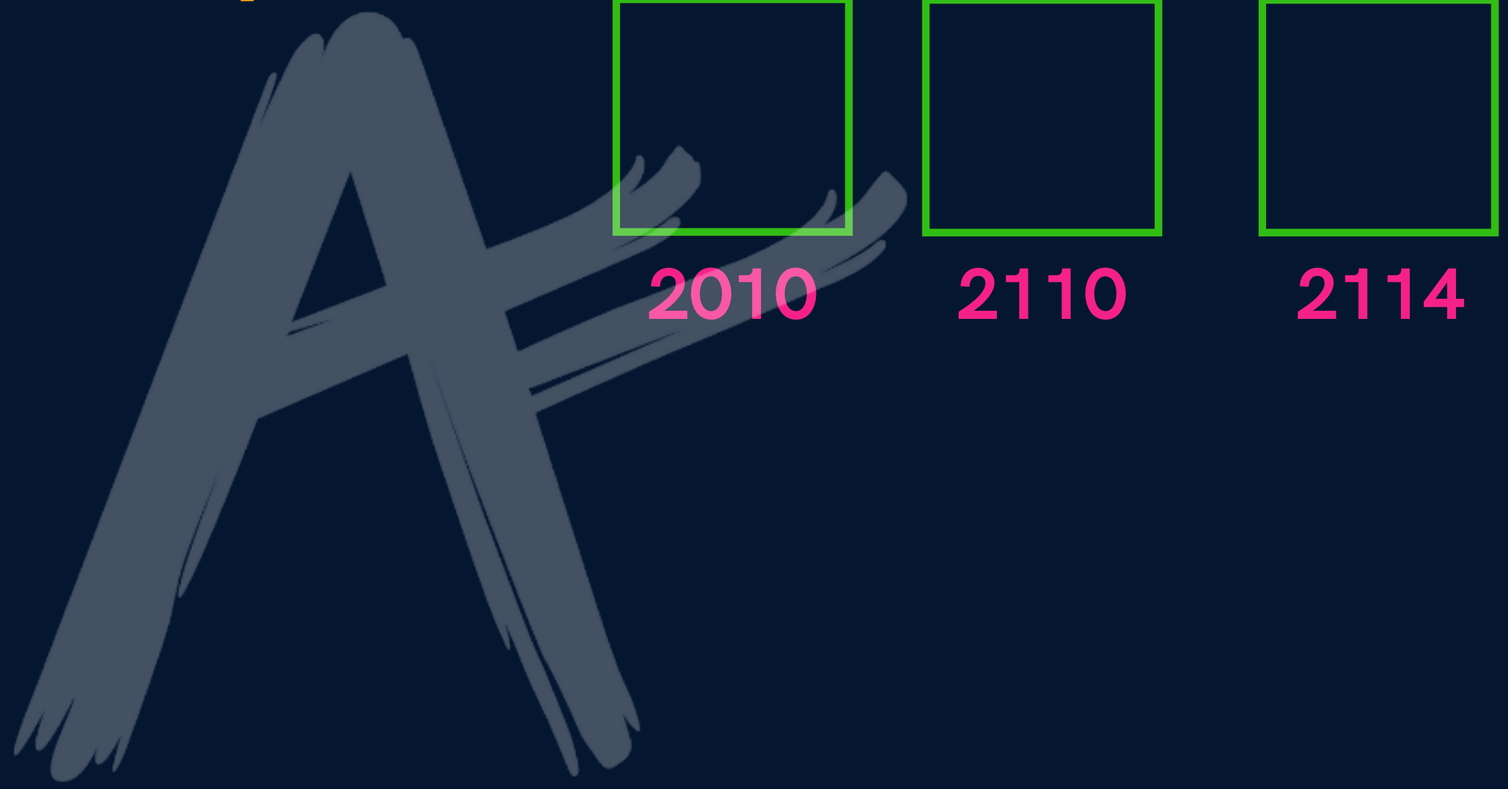
```
struct student s1;
s1.cgpa = 7.5;
```

Syntax

```
struct student {
    char name[100];
    int roll;
    float cgpa;
}
```

Structures in Memory

```
struct student {
    char name[100];
    int roll;
    float cgpa;
}
```



structures are stored in contiguous memory locations

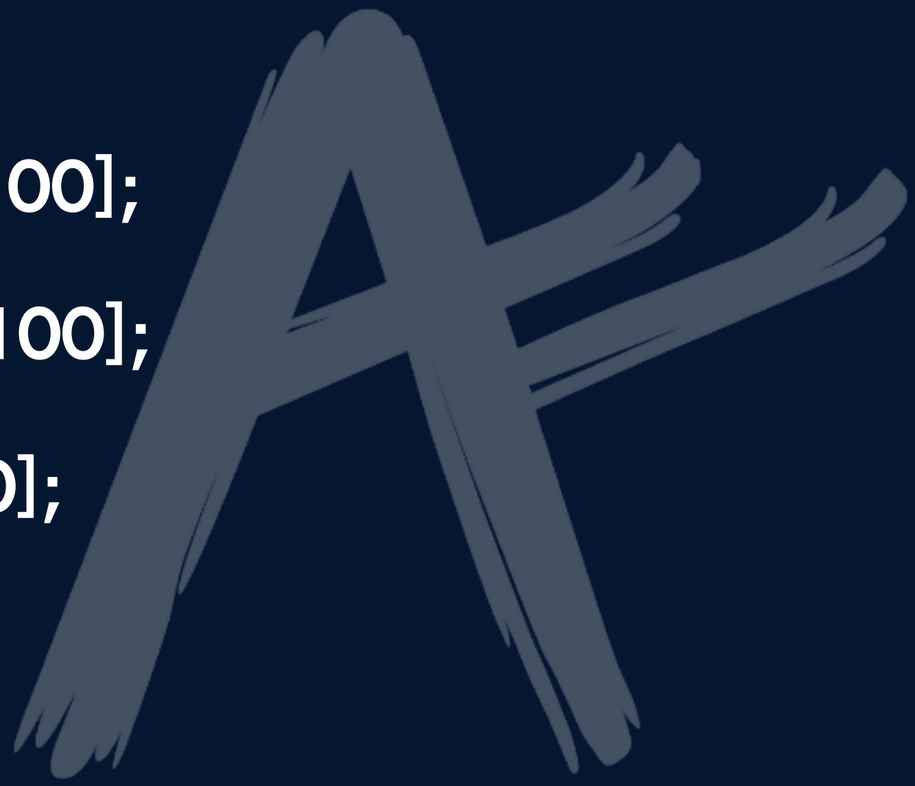
Benefits of using Structures

- Saves us from creating too many variables

- Good data management/organization

Array of Structures

```
struct student ECE[100];

struct student COE[100];

struct student IT[100];
```

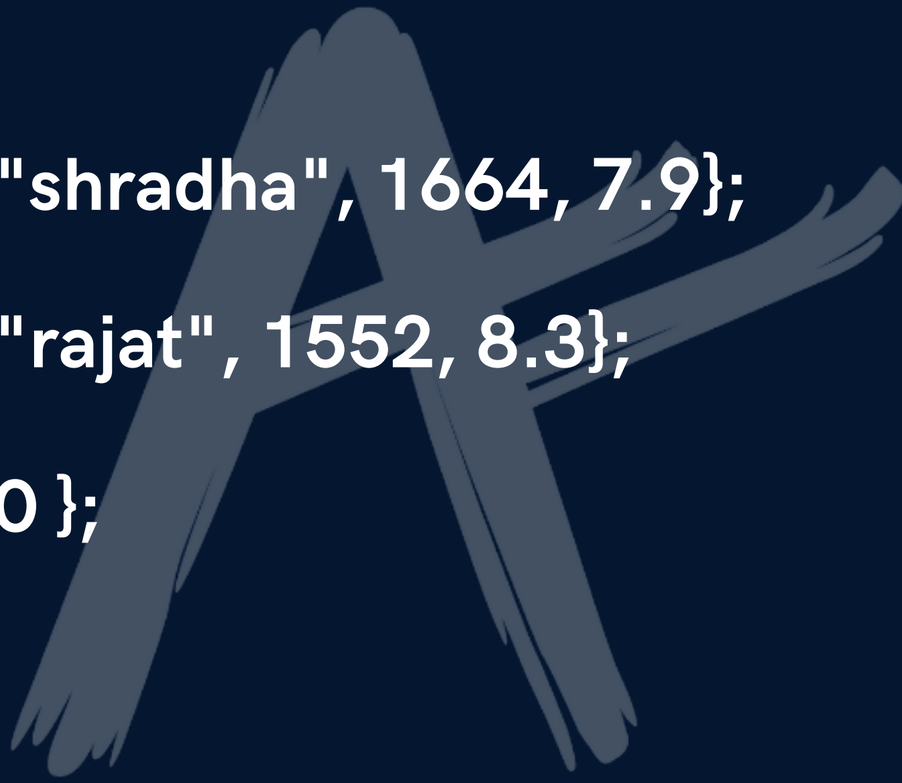


ACCESS

```
IT[0].roll = 200;

IT[0].cgpa = 7.6;
```

Initializing Structures

```
struct student s1 = { "shradha", 1664, 7.9};

struct student s2 = { "rajat", 1552, 8.3};

struct student s3 = { 0 };
```



Pointers to Structures

```
struct student s1;

struct student *ptr;

ptr =&s1;
```

Arrow Operator

`(*ptr).code` ⟷ `ptr->code`

Passing structure to function

```
//Function Prototype
void printInfo(struct student s1);
```

typedef Keyword

↓

used to create alias for data types

```
typedef struct ComputerEngineeringStudent{
    int roll;
    float cgpa;
    char name[100];
} coe;
```

coe student1;

C Language Tutorial

(Basic to Advanced)

Topics to be covered :

Structures

(Chapter 9)

1. Structures

```c
# include <stdio.h>
# include <string.h>

struct student {
   char name[100];
   int roll;
   float cgpa;
};

typedef struct ComputerEngineeringStudent{
   int roll;
   float cgpa;
   char name[100];
} coe;

void printInfo(struct student s1);

int main() {
```

```
struct student s1;
// s1.name = "Shradha"; // not a modifiable value
strcpy(s1.name,"Shradha");
s1.roll = 64;
s1.cgpa = 9.2;

printf("student info : \n");
printf("name = %s\n", s1.name);
printf("roll no = %d\n", s1.roll);
printf("cgpa = %f\n", s1.cgpa);


//array of structures
struct student IT[60];
struct student COE[60];
struct student ECE[60];

//declaration
struct student s2 = {"Rajat", 1552, 8.6};
struct student s3 = {0};

printf("roll no of s2 = %d\n", s2.roll);
printf("roll no of s3 = %d\n", s3.roll);

//pointer to structure
struct student *ptr = &s1;
printf("student.name = %s\n", (*ptr).name);
printf("student.roll = %d\n", (*ptr).roll);
printf("student.cgpa = %f\n", (*ptr).cgpa);

//arrow operator
printf("student->name = %s\n", ptr->name);
printf("student->roll = %d\n", ptr->roll);
printf("student->cgpa = %f\n", ptr->cgpa);

//Passing structure to function
printInfo(s1);

//typedef keyword
coe student1;
student1.roll = 1664;
student1.cgpa = 6.7;
```

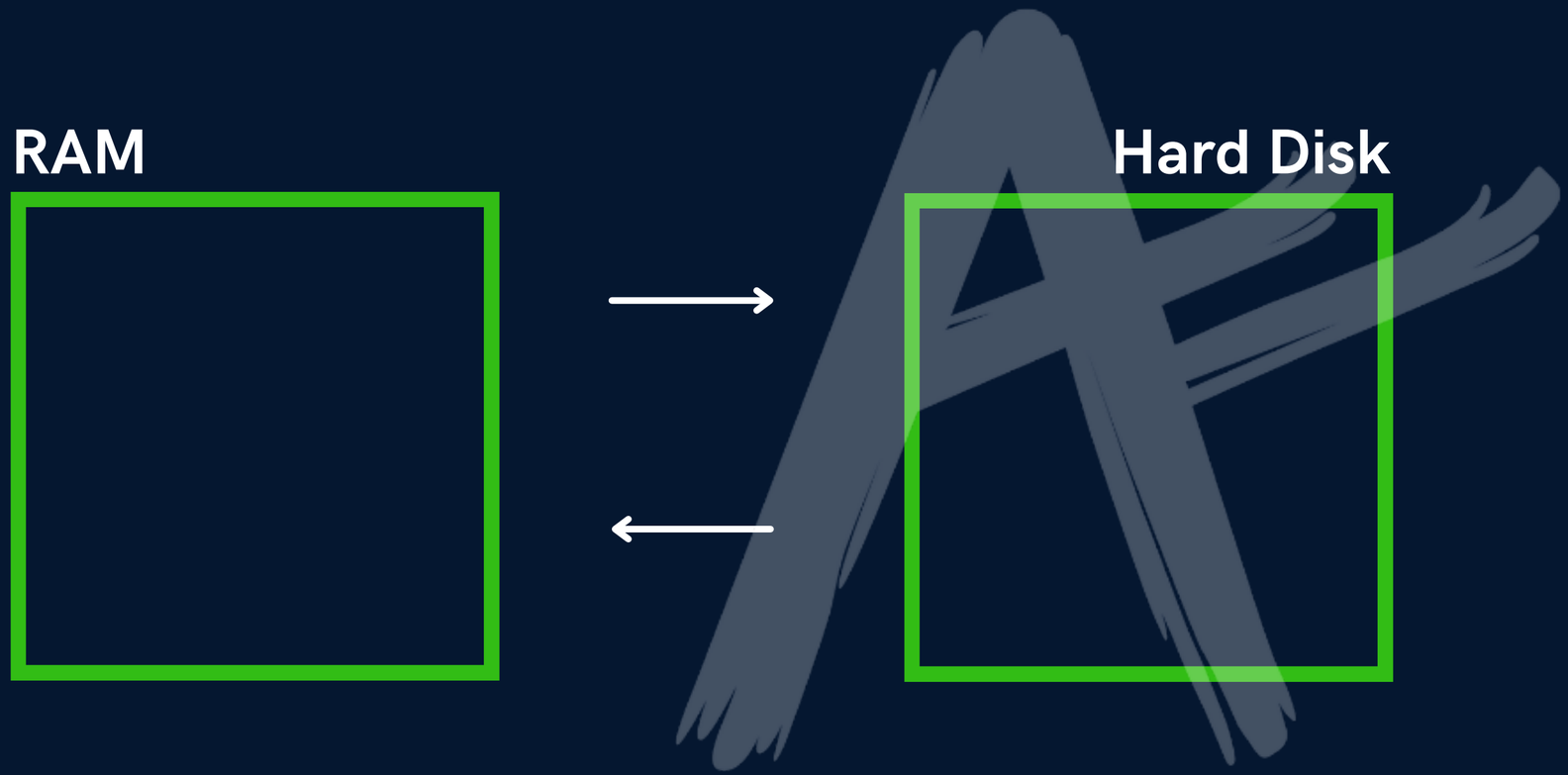
```
    strcpy(student1.name, "sudhir");

    return 0;
}

void printInfo(struct student s1) {
    printf("student info : \n");
    printf("name = %s\n", s1.name);
    printf("roll no = %d\n", s1.roll);
    printf("cgpa = %f\n", s1.cgpa);

    //change
    s1.roll = 1660; //but it won't be reflected to the main function
                    //as structures are passed by value
}
```

> Some more Qs

```
# include <stdio.h>
# include <string.h>

//user defined
typedef struct student {
    int roll;
    float cgpa;
    char name[100];
} stu ;

typedef struct computerengineeringstudent {
    int roll;
    float cgpa;
    char name[100];
} coe;

struct address {
    int houseNo;
    int block;
    char city[100];
    char state[100];
};

struct vector {
    int x;
```

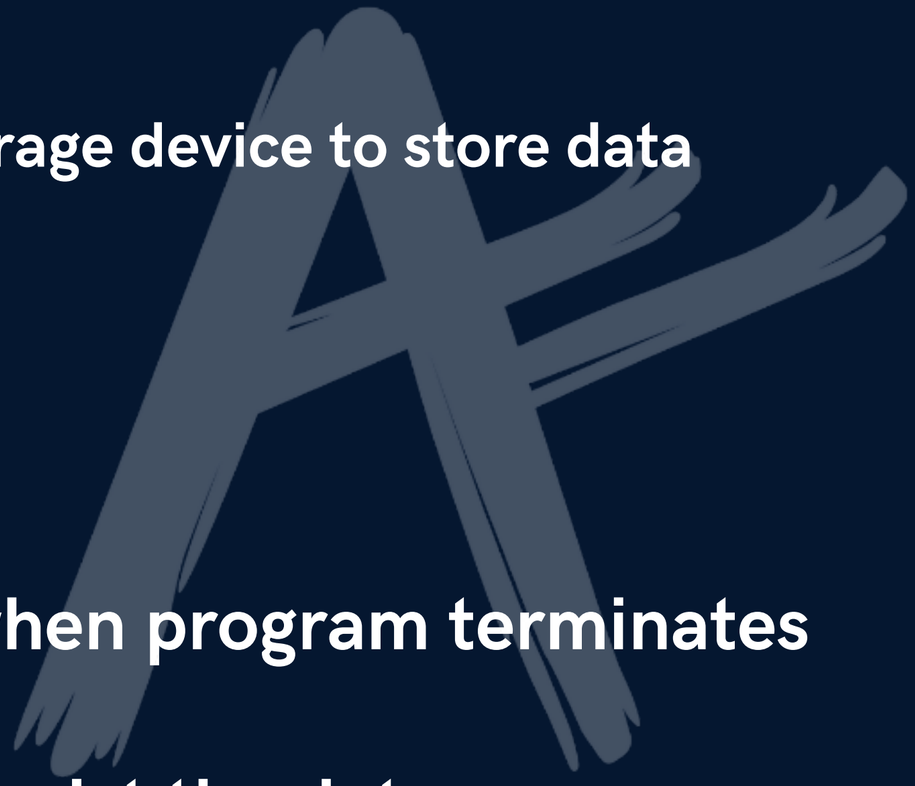
```
    int y;
};

void calcSum(struct vector v1, struct vector v2, struct vector sum);

struct complex {
    int real;
    int img;
};

typedef struct BankAccount {
    int accountNo;
    char name[100];
} acc ;

int main() {
    acc acc1 = {123, "shradha"};
    acc acc2 = {124, "rajat"};
    acc acc3 = {125, "sudhir"};

    printf("acc no = %d", acc1.accountNo);
    printf("name = %s", acc1.name);
    return 0;
}

void calcSum(struct vector v1, struct vector v2, struct vector sum) {
    sum.x = v1.x + v2.x;
    sum.y = v1.y + v2.y;

    printf("sum of x is : %d\n", sum.x);
    printf("sum of y is : %d\n", sum.y);
}
```

File IO



File IO

FILE - container in a storage device to store data



- RAM is volatile

- Contents are lost when program terminates

- Files are used to persist the data

Operation on Files

Create a File

Open a File

Close a File

Read from a File

Write in a File

Types of Files

Text Files

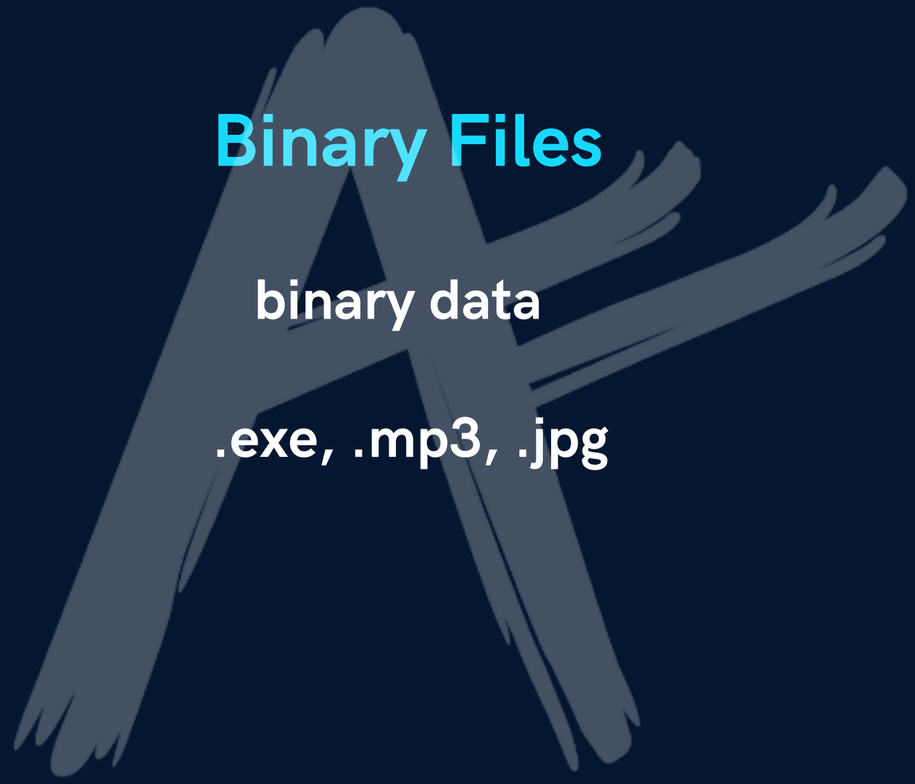
textual data

.txt, .c

Binary Files

binary data

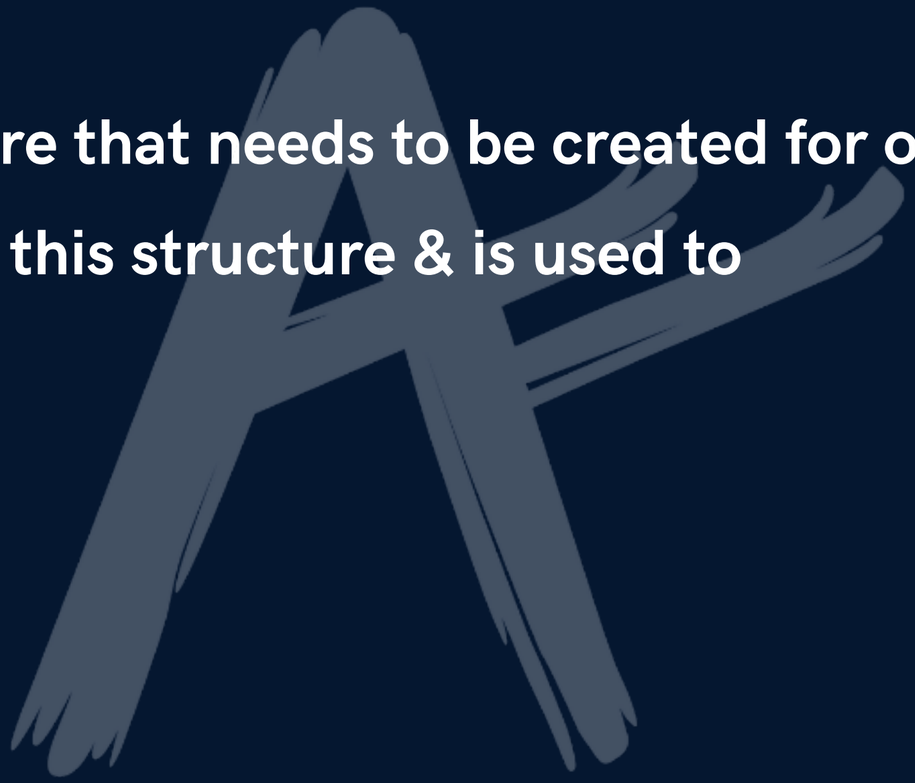
.exe, .mp3, .jpg



File Pointer

FILE is a (hidden)structure that needs to be created for opening a file

A FILE ptr that points to this structure & is used to access the file.



```
FILE *fptr;
```

Opening a File

```
FILE *fptr;

fptr = fopen("filename", mode);
```

Closing a File

```
fclose(fptr);
```

File Opening Modes

"r"	open to read
"rb"	open to read in binary
"w"	open to write
"wb"	open to write in binary
"a"	open to append

BEST Practice

Check if a file exists before reading from it.

Reading from a file

```
char ch;

fscanf(fptr, "%c", &ch);
```

Writing to a file

```
char ch = 'A';

fprintf(fptr, "%c", ch);
```

Read & Write a char

```
fgetc(fptr)

fputc( 'A', fptr)
```

EOF (End Of File)

fgetc returns EOF to show that the file has ended

C Language Tutorial

(Basic to Advanced)

Topics to be covered :

File I/O

(Chapter 10)

```c
# include <stdio.h>

int main() {
   FILE *fptr;
   //Reading a file
   char ch;
   fptr = fopen("Test.txt", "r");
   if(fptr == NULL) {
       printf("doesn't exist!\n");
   } else {
       fscanf(fptr, "%c", &ch);
       printf("character in file is : %c\n", ch);
       fscanf(fptr, "%c", &ch);
       printf("character in file is : %c\n", ch);
       fclose(fptr);
   }

   //Writing in a file
   ch = 'M';
   fptr = fopen("NewFile.txt", "w");
```

```
    fprintf(fptr, "%cANGO", ch);
    fclose(fptr);

    //fgets
    fptr = fopen("NewFile.txt", "r");
    printf("character in file is : %c\n", fgetc(fptr));
    printf("character in file is : %c\n", fgetc(fptr));
    printf("character in file is : %c\n", fgetc(fptr));
    printf("character in file is : %c\n", fgetc(fptr));
    printf("character in file is : %c\n", fgetc(fptr));
    fclose(fptr);

    //fputc
    fptr = fopen("NewFile.txt", "w");
    fputc('a', fptr);
    fputc('p', fptr);
    fputc('p', fptr);
    fputc('l', fptr);
    fputc('e', fptr);
    fclose(fptr);

    //read the full file (EOF)
    fptr = fopen("NewFile.txt", "r");
    ch = fgetc(fptr);
    while(ch != EOF) {
        printf("%c", ch);
        ch = fgetc(fptr);
    }
    printf("\n");
    fclose(fptr);

    return 0;
}
```

Dynamic Memory Allocation

It is a way to allocate memory to a data structure during the runtime.

We need some functions to allocate
& free memory dynamically.

Functions for DMA

a. malloc( )

b. calloc( )

c. free( )

d. realloc( )

malloc( )

memory allocation

takes number of bytes to be allocated

& returns a pointer of type void

```
ptr = (*int) malloc(5 * sizeof(int));
```

calloc( )

continuous allocation

initializes with 0

```
ptr = (*int) calloc(5, sizeof(int));
```

free( )

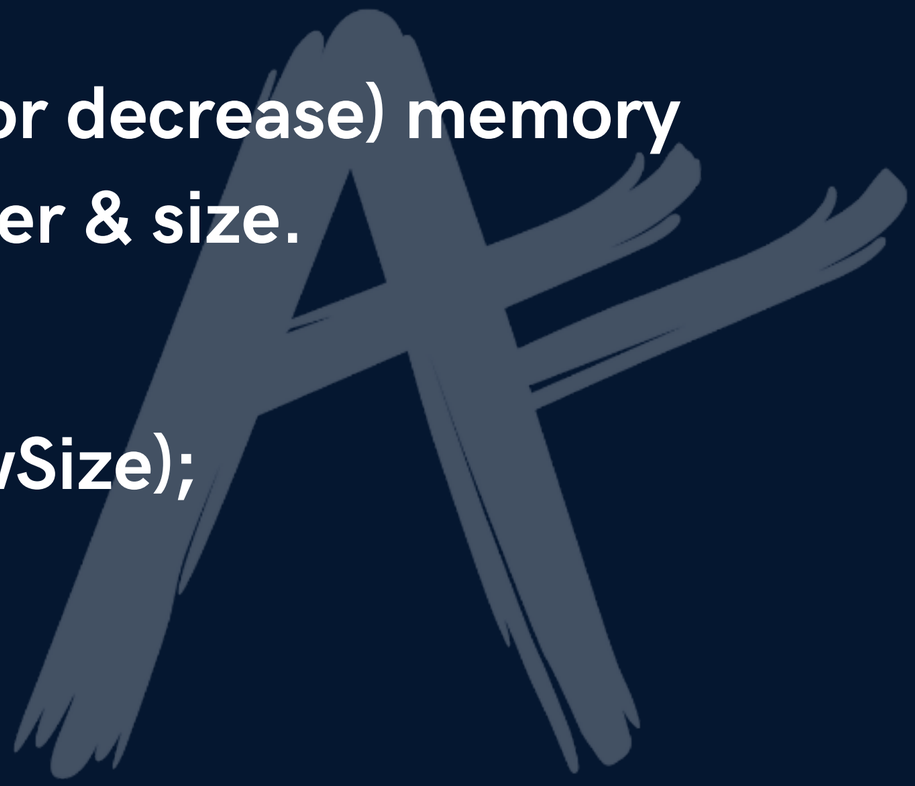
We use it to free memory that is allocated using malloc & calloc

```
free(ptr);
```

realloc( )

reallocate (increase or decrease) memory
using the same pointer & size.

```
ptr = realloc(ptr, newSize);
```



C Language Tutorial

(Basic to Advanced)

Topics to be covered :

Dynamic Memory Allocation

(Chapter 11)

```c
# include <stdio.h>
# include <stdlib.h>
//Dynamic Memory Allocation

int main() {
   //sizeof function
   printf("%d\n", sizeof(int));
   printf("%d\n", sizeof(float));
   printf("%d\n", sizeof(char));

   //malloc
   // int *ptr;
   // ptr = (int *) malloc(5 * sizeof(int));

   // for(int i=0; i<5; i++) {
   //     scanf("%d", &ptr[i]);
   // }

   // for(int i=0; i<5; i++) {
   //     printf("number %d = %d\n", i+1, ptr[i]);
```

```
    // }

    //calloc
    int *ptr = (int *) calloc(5, sizeof(int));

    for(int i=0; i<5; i++) {
        printf("number %d = %d\n", i+1, ptr[i]);
    }

    //free
    free(ptr);

    return 0;
}
```