



## EXPERIMENT 7 : STRUCTURES & UNIONS

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**Activity 1:** Write a C program that uses functions to perform the following operations:

- a. Reading a complex number.
- b. Writing a complex number.
- c. Addition and subtraction of two complex numbers.

**Note:** Represent complex number using a structure.

### ALGORITHM:

**STEP 1: START**

**STEP 2:** Define structure Complex with real and imag.

**STEP 3:** Create function **readComplex()** to read real and imaginary parts.

**STEP 4:** Create function **writeComplex()** to print complex number.

**STEP 5:** Create **addComplex()** to add two complex numbers.

**STEP 6:** Create **subComplex()** to subtract two complex numbers.

**STEP 7:** Read first complex number into **c1**.

**STEP 8:** Read second complex number into **c2**.

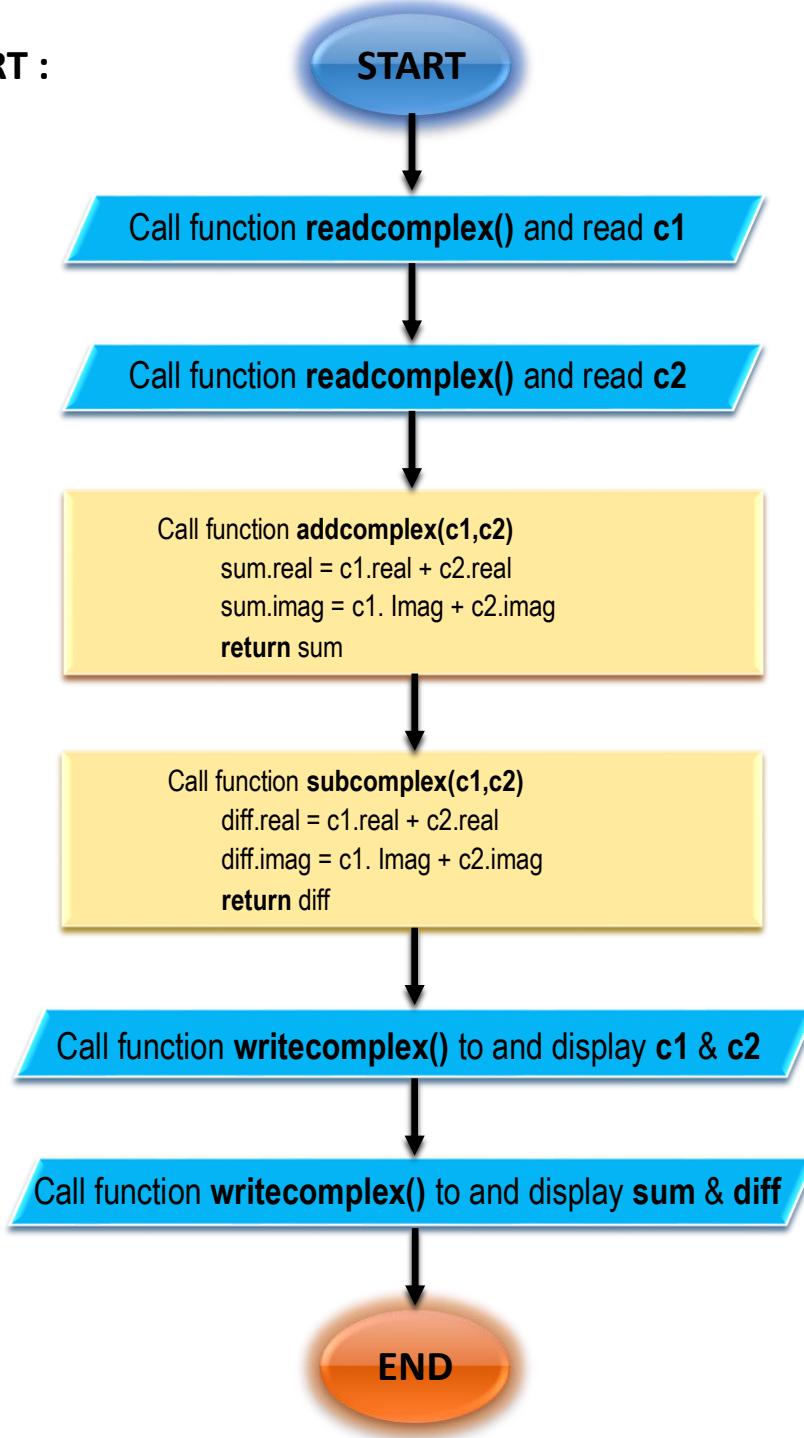
**STEP 9:** Compute **sum = addComplex(c1, c2)**.

**STEP 10:** Compute **diff = subComplex(c1, c2)**.

**STEP 11:** Display **c1, c2, sum, and diff** using **writeComplex()**.

**STEP 12: END**

FLOWCHART :



## PSEUDOCODE :

```
STRUCT Complex
    real : float
    imag : float
ENDSTRUCT

FUNCTION readComplex() RETURNS Complex
    DECLARE c AS Complex
    PRINT "Enter real part: "
    READ c.real
    PRINT "Enter imaginary part: "
    READ c.imag
    RETURN c
ENDFUNCTION

FUNCTION writeComplex(c AS Complex)
    IF c.imag >= 0 THEN
        PRINT formatted: c.real + " + " + c.imag + "i"
    ELSE
        PRINT formatted: c.real + " - " + abs(c.imag) + "i"
    ENDIF
ENDFUNCTION

FUNCTION addComplex(c1 AS Complex, c2 AS Complex) RETURNS Complex
    DECLARE sum AS Complex
    sum.real = c1.real + c2.real
    sum.imag = c1.imag + c2.imag
    RETURN sum
ENDFUNCTION

FUNCTION subComplex(c1 AS Complex, c2 AS Complex) RETURNS Complex
    DECLARE diff AS Complex
    diff.real = c1.real - c2.real
    diff.imag = c1.imag - c2.imag
    RETURN diff
ENDFUNCTION

MAIN
    DECLARE c1, c2, sum, diff AS Complex

    PRINT "Enter first complex number"
    c1 = readComplex()

    PRINT "Enter second complex number"
```

```
c2 = readComplex()

sum = addComplex(c1, c2)
diff = subComplex(c1, c2)

PRINT "First complex number: "
writeComplex(c1)

PRINT "Second complex number: "
writeComplex(c2)

PRINT "Sum: "
writeComplex(sum)

PRINT "Difference: "
writeComplex(diff)
ENDMAIN
```

## CODE :

```
#include <stdio.h>

struct Complex {
    float real;
    float imag;
};

struct Complex readComplex() {
    struct Complex c;
    printf("Enter real part: ");
    scanf("%f", &c.real);
    printf("Enter imaginary part: ");
    scanf("%f", &c.imag);
    return c;
}

void writeComplex(struct Complex c) {
    if (c.imag >= 0)
        printf("%.2f + %.2fi\n", c.real, c.imag);
    else
        printf("%.2f - %.2fi\n", c.real, -c.imag);
```

```
}

struct Complex addComplex(struct Complex c1, struct Complex c2) {
    struct Complex sum;
    sum.real = c1.real + c2.real;
    sum.imag = c1.imag + c2.imag;
    return sum;
}

struct Complex subComplex(struct Complex c1, struct Complex c2) {
    struct Complex diff;
    diff.real = c1.real - c2.real;
    diff.imag = c1.imag - c2.imag;
    return diff;
}

int main() {
    struct Complex c1, c2, sum, diff;

    printf("Enter first complex number\n");
    c1 = readComplex();

    printf("\nEnter second complex number:\n");
    c2 = readComplex();

    sum = addComplex(c1, c2);
    diff = subComplex(c1, c2);

    printf("\nFirst complex number: ");
    writeComplex(c1);

    printf("Second complex number: ");
    writeComplex(c2);

    printf("\nSum: ");
    writeComplex(sum);

    printf("Difference: ");
    writeComplex(diff);

    return 0;
}
```

## OUTPUT :



The screenshot shows a terminal window with the following text output:

```
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
PS C:\Users\Lenovo\OneDrive\Documents\100_Days_of_code\Q131-140> cd "c:\Users\Lenovo\Downloads\C programming\EXP7\" ; if ($?) { gcc exp7_1.c -o exp7_1 } ; if ($?) { ./exp7_1 }
Enter first complex number
Enter real part: 4.7
Enter imaginary part: 6

Enter second complex number:
Enter real part: 3.6
Enter imaginary part: 5.3

First complex number: 4.70 + 6.00i
Second complex number: 3.60 + 5.30i

Sum: 8.30 + 11.30i
Difference: 1.10 + 0.70i
PS C:\Users\Lenovo\Downloads\C programming\EXP7>
```

**Activity 2 :** WAP to read a list of integers and store it in a single dimensional array. Write a C program to count and display positive, negative, odd, and even numbers in an array.

### ALGORITHM:

**STEP 1: START**

**STEP 2:** Declare structure Employee with **name**, **basic**, and **gross**.

**STEP 3:** Declare an array **emp[100]**.

**STEP 4:** Read number of employees **n**.

**STEP 5: Repeat** for each employee (**i = 0 to n-1**):

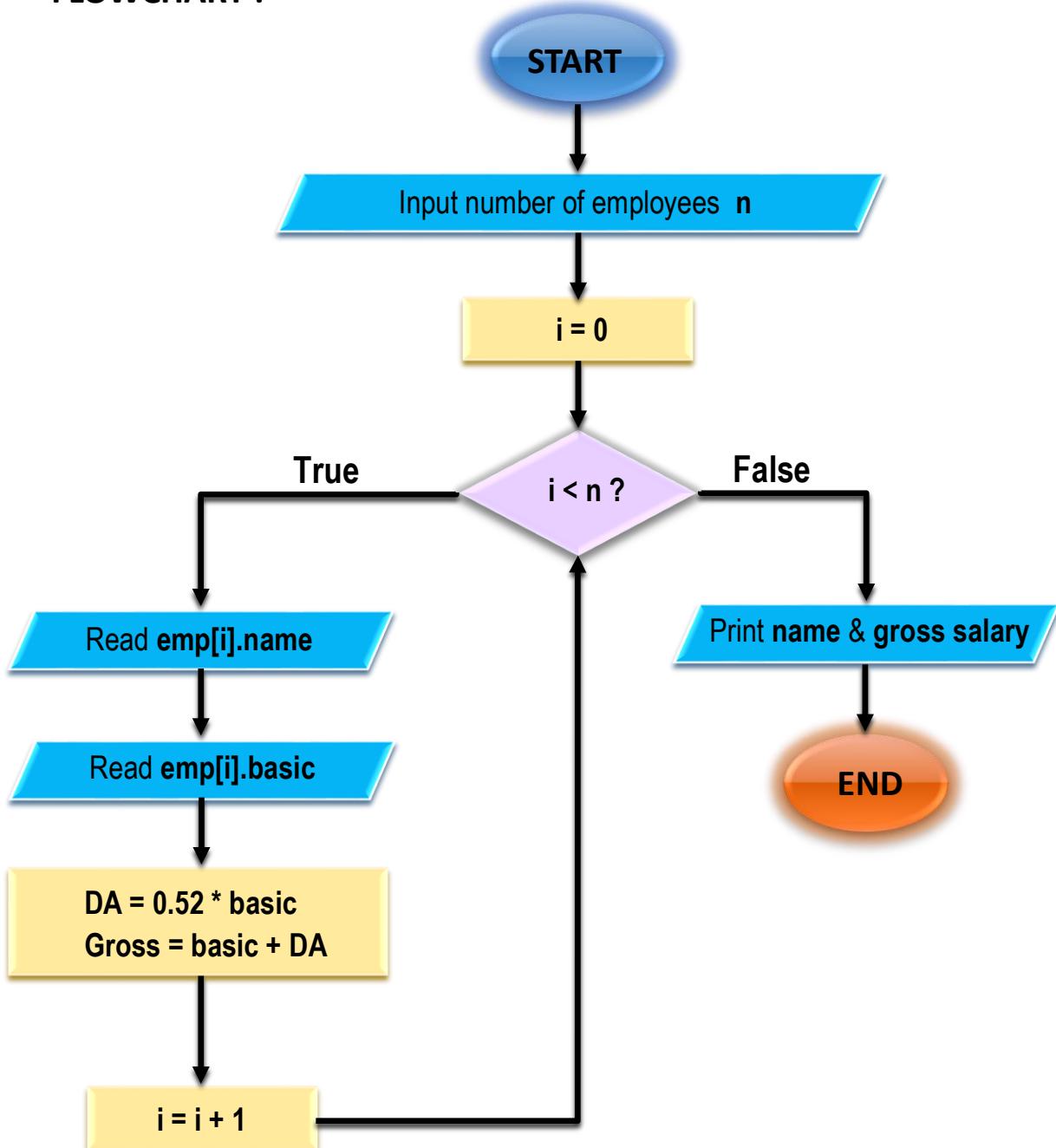
- a) Read employee name
- b) Read basic pay
- c) Compute DA = 52% of basic pay
- d) Compute gross = basic + DA

**STEP 6: Repeat** for each employee

Print name and gross salary

**STEP 7: END**

**FLOWCHART :**



## PSEUDOCODE :

```
BEGIN

    DECLARE Employee array emp[100]
    DECLARE integer n, i
    DECLARE float DA

    PRINT "Enter number of employees"
    READ n

    FOR i = 0 TO n - 1 DO
        PRINT "Enter name of employee i"
        READ emp[i].name

        PRINT "Enter basic pay of employee"
        READ emp[i].basic

        DA = 0.52 * emp[i].basic
        emp[i].gross = emp[i].basic + DA
    END FOR

    PRINT "Name      Gross Salary"

    FOR i = 0 TO n - 1 DO
        PRINT emp[i].name, emp[i].gross
    END FOR

END
```

## CODE :

```
#include <stdio.h>

struct Employee {
    char name[50];
    float basic, gross;
};
```

```
int main() {
    struct Employee emp[100];
    int n, i;
    float da;

    printf("Enter number of employees (max 100): ");
    scanf("%d", &n);

    for (i = 0; i < n; i++) {
        printf("\nEnter name of employee %d: ", i + 1);
        scanf("%s", emp[i].name);
        printf("Enter basic pay of %s: ", emp[i].name);
        scanf("%f", &emp[i].basic);

        da = 0.52 * emp[i].basic;
        emp[i].gross = emp[i].basic + da;
    }

    printf("\nName\tGross Salary\n");
    printf("-----\n");
    for (i = 0; i < n; i++) {
        printf("%s\t%.2f\n", emp[i].name, emp[i].gross);
    }

    return 0;
}
```

## OUTPUT :

```
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
PS C:\Users\Lenovo\Downloads\C programming\EXP7> cd "c:\Users\Lenovo\Downloads\C programming\EXP7\" ; if ($?) { gcc tempCodeRunnerFile.c -o tempCodeRunnerFile } ; if ($?) { ./tempCodeRunnerFile }
Enter number of employees (max 100): 2

Enter name of employee 1: Rakesh
Enter basic pay of Rakesh: 15000

Enter name of employee 2: Nitin
Enter basic pay of Nitin: 35000

Name      Gross Salary
-----
Rakesh    15800.00
Nitin     353.20
PS C:\Users\Lenovo\Downloads\C programming\EXP7>
```

**Activity 3 :** Create a Book structure containing `book_id`, `title`, `author name` and `price`. Write a C program to pass a structure as a function argument and print the book details.

#### ALGORITHM:

**STEP 1: START**

**STEP 2:** Define structure `Book` with fields: `book_id`, `title`, `author`, `price`

**STEP 3:** Declare variable `b1` of type `Book`

**STEP 4:** Read Book ID into `b1.book_id`

**STEP 5:** Read Book Title into `b1.title`

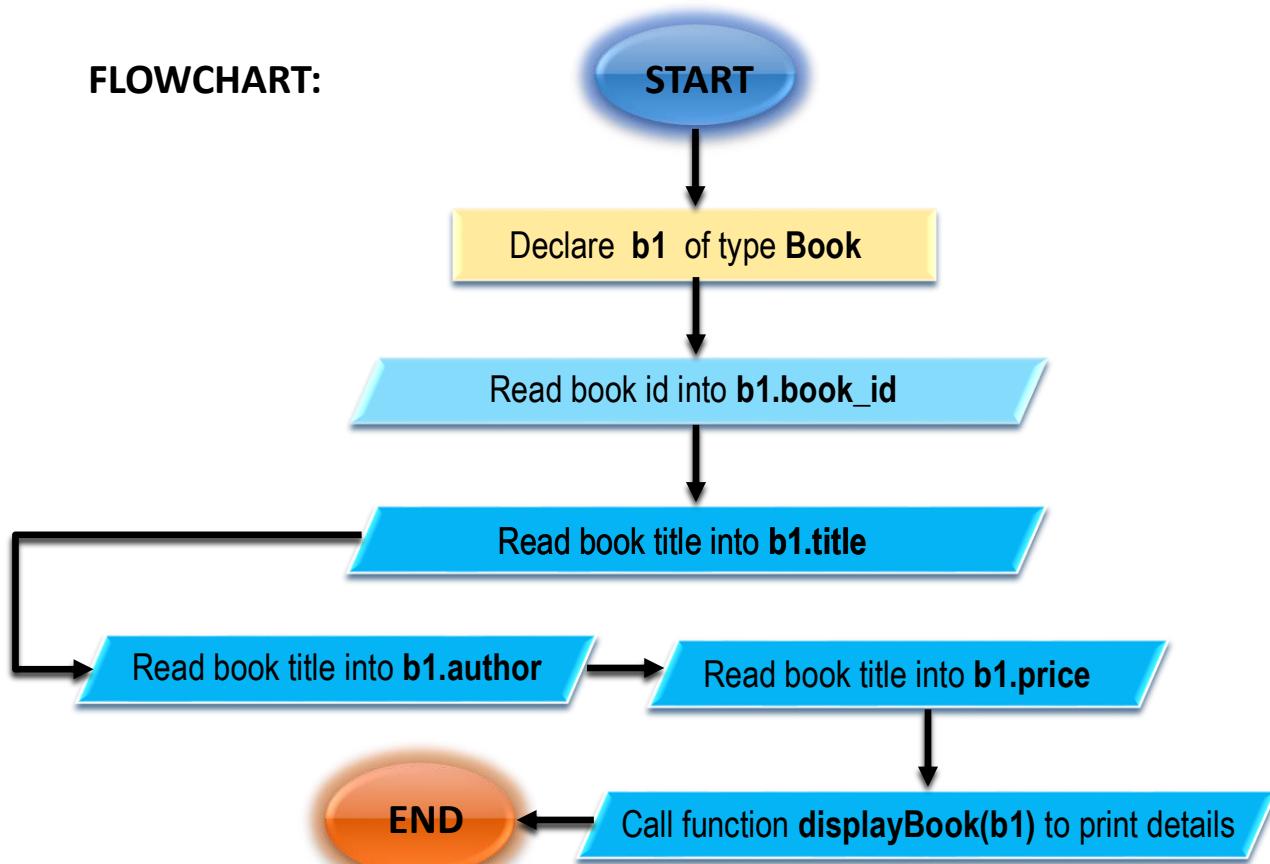
**STEP 6:** Read Author Name into `b1.author`

**STEP 7:** Read Book Price into `b1.price`

**STEP 8:** Call function `displayBook(b1)` to print the details

**STEP 9: END**

#### FLOWCHART:



## PSEUDOCODE :

```
START

DECLARE structure Book with:
    book_id : integer
    title   : string
    author  : string
    price   : float

DECLARE b1 as Book

PRINT "Enter Book ID"
READ b1.book_id

PRINT "Enter Book Title"
READ b1.title

PRINT "Enter Author Name"
READ b1.author

PRINT "Enter Book Price"
READ b1.price

CALL displayBook(b1)

END

FUNCTION displayBook(b)
    PRINT "Book Details:"
    PRINT "Book ID   :", b.book_id
    PRINT "Title     :", b.title
    PRINT "Author    :", b.author
    PRINT "Price     :", b.price
END FUNCTION
```

## CODE :

```
#include <stdio.h>

struct Book {
    int book_id;
    char title[50];
    char author[50];
    float price;
};

void displayBook(struct Book b) {
    printf("\nBook Details:\n");
    printf("Book ID : %d\n", b.book_id);
    printf("Title : %s\n", b.title);
    printf("Author : %s\n", b.author);
    printf("Price : %.2f\n", b.price);
}

int main() {
    struct Book b1;

    printf("Enter Book ID: ");
    scanf("%d", &b1.book_id);
    printf("Enter Book Title: ");
    scanf(" %[^\n]", b1.title);
    printf("Enter Author Name: ");
    scanf(" %[^\n]", b1.author);
    printf("Enter Book Price: ");
    scanf("%f", &b1.price);

    displayBook(b1);

    return 0;
}
```

## OUTPUT :

```
PROBLEMS    OUTPUT    DEBUG CONSOLE    TERMINAL    PORTS

PS C:\Users\Lenovo\Downloads\C programming\EXP7> cd "c:\Users\Lenovo\Downloads\C programming\EXP7\" ; if ($?) { gcc tempCodeRunnerFile.c -o tempCodeRunnerFile } ; if ($?) { .\tempCodeRunnerFile }

Enter Book ID: 101
Enter Book Title: The Alchemist
Enter Author Name: Paulo Coehlo
Enter Book Price: 399.00

Book Details:
Book ID : 101
Title : The Alchemist
Author : Paulo Coehlo
Price : 399.00
PS C:\Users\Lenovo\Downloads\C programming\EXP7>
```

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**Activity 4 :** Create a union containing 6 strings: name, home\_address, hostel\_address, city, state, and zip. Write a C program to display your present address..

## ALGORITHM:

**STEP 1: START**

**STEP 2:** Declare a union **Address** with fields:

**name, home\_address, hostel\_address, city, state, zip**

**STEP 3:** Declare a variable **addr** of type **Address**

**STEP 4:** Read name into **addr.name**

**STEP 5:** Read **home\_address** into **addr.home\_address**

**STEP 6:** Read **hostel\_address** (present address) into **addr.hostel\_address**

**STEP 7:** Read city into **addr.city**

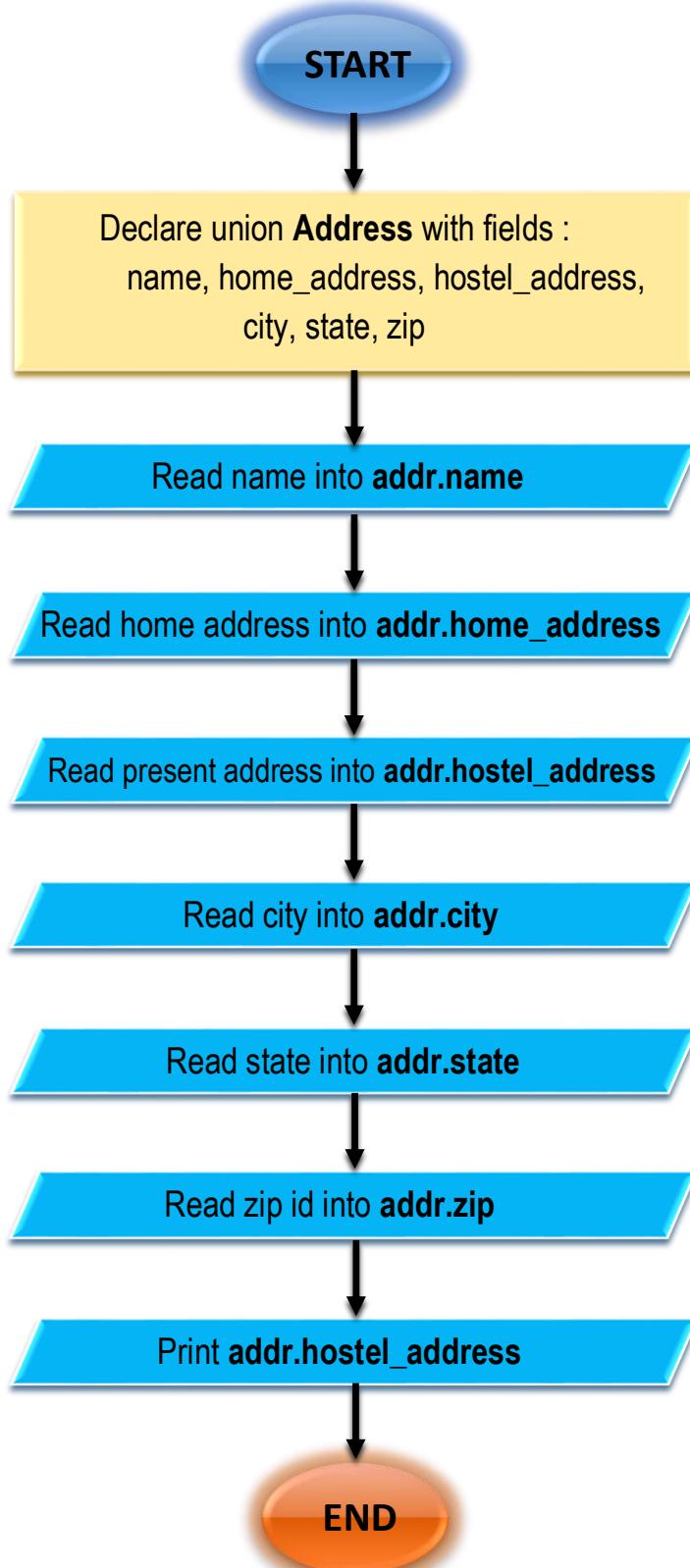
**STEP 8:** Read state into **addr.state**

**STEP 9:** Read zip into **addr.zip**

**STEP 10:** Print the present address stored in **addr.hostel\_address**

**STEP 11: END**

**FLOWCHART:**



## PSEUDOCODE :

START

```
DECLARE union Address with:  
    name : string  
    home_address : string  
    hostel_address : string  
    city : string  
    state : string  
    zip : string  
  
DECLARE addr as Address  
  
PRINT "Enter your name"  
READ addr.name  
  
PRINT "Enter your home address"  
READ addr.home_address  
  
PRINT "Enter your present (hostel) address"  
READ addr.hostel_address  
  
PRINT "Enter your city"  
READ addr.city  
  
PRINT "Enter your state"  
READ addr.state  
  
PRINT "Enter your zip"  
READ addr.zip  
  
PRINT "Present Address:", addr.hostel_address
```

END

## CODE :

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

union Address {
    char name[50];
    char home_address[100];
    char hostel_address[100];
    char city[50];
    char state[50];
    char zip[10];
};

int main() {
    union Address addr;

    printf("Enter your name: ");
    scanf("%s", addr.name);

    printf("Enter your home address: ");
    scanf(" %[^\n]", addr.home_address);

    printf("Enter your present address (hostel address): ");
    scanf(" %[^\n]", addr.hostel_address);

    printf("Enter your city: ");
    scanf("%s", addr.city);

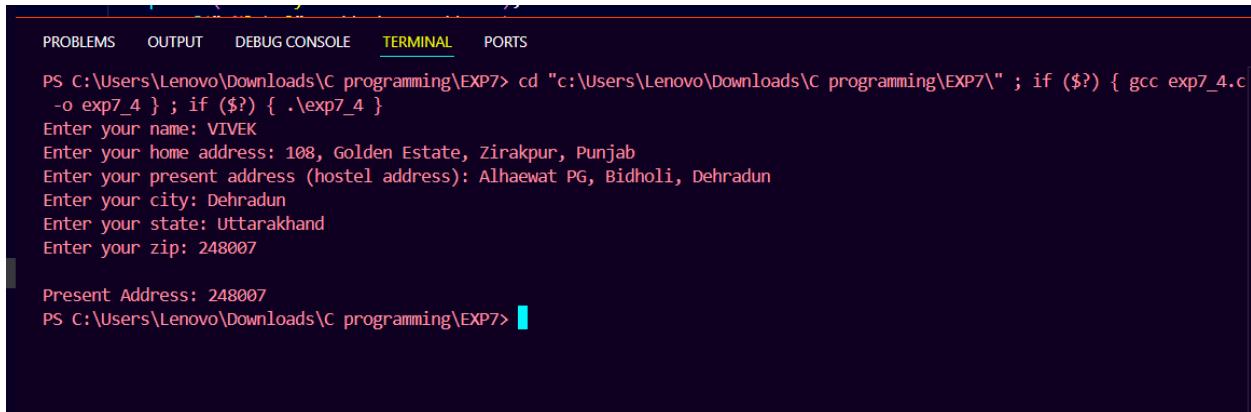
    printf("Enter your state: ");
    scanf("%s", addr.state);

    printf("Enter your zip: ");
    scanf("%s", addr.zip);

    printf("\nPresent Address: %s\n", addr.hostel_address);

    return 0;
}
```

## OUTPUT :



```
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS
PS C:\Users\Lenovo\Downloads\C programming\EXP7> cd "c:\Users\Lenovo\Downloads\C programming\EXP7\" ; if ($?) { gcc exp7_4.c -o exp7_4 } ; if ($?) { ./exp7_4 }
Enter your name: VIVEK
Enter your home address: 108, Golden Estate, Zirakpur, Punjab
Enter your present address (hostel address): Alhaewat PG, Bidholi, Dehradun
Enter your city: Dehradun
Enter your state: Uttarakhand
Enter your zip: 248007
Present Address: 248007
PS C:\Users\Lenovo\Downloads\C programming\EXP7>
```