Question 1(a) [3 marks]

List any six keywords of C language.

Answer:

Category	Keywords
Data Types	int, float, char
Control Flow	if, for, return

Mnemonic: "I Find Clever Reasons For Results"

Question 1(b) [4 marks]

Define Operator. Summarize types of operators based on operands.

Answer:

Operator: Symbol that performs operations on operands to produce a result.

Type	Description	Examples
Unary	Single operand	++, --, !
Binary	Two operands	+, -, *, /, %
Ternary	Three operands	?:

Mnemonic: "U-B-T: Use Binary Then Ternary"

Question 1(c) [7 marks]

Define flowchart. Draw flowchart symbols. Draw flowchart to find minimum of two integer numbers N1 & N2.

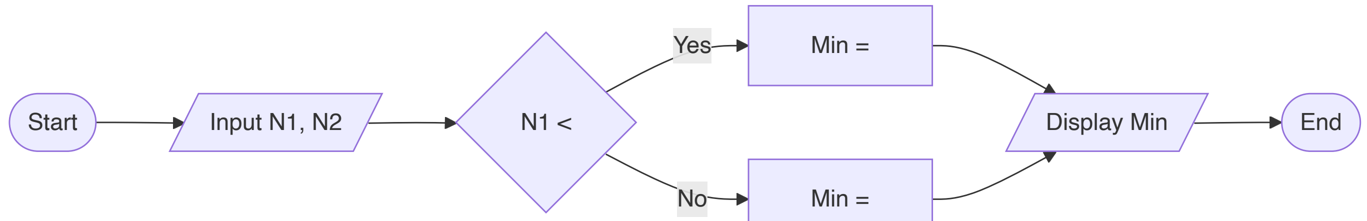
Answer:

Flowchart: Graphical representation of algorithm using standardized symbols to show the sequence of operations.

Common Flowchart Symbols:

Symbol	Meaning
Oval	Start/Stop
Parallelogram	Input/Output
Rectangle	Process
Diamond	Decision
Arrow	Flow direction

Flowchart to find minimum of N1 & N2:



Mnemonic: "SPADE: Start-Process-Arrow-Decision-End"

Question 1(c) OR [7 marks]

Define algorithm. Write an algorithm to calculate area and circumference of circle.

Answer:

Algorithm: Step-by-step procedure to solve a problem using finite number of well-defined instructions.

Algorithm to calculate area and circumference of circle:

1. **Start**
2. **Input radius r**
3. **Set PI = 3.14159**
4. **Calculate area = PI × r × r**
5. **Calculate circumference = 2 × PI × r**
6. **Display area and circumference**
7. **Stop**

Table of formulas used:

Measurement	Formula
Area	$\pi \times r^2$
Circumference	$2 \times \pi \times r$

Mnemonic: "RICARD: Radius Input, Calculate Area, Reveal Dimensions"

Question 2(a) [3 marks]

Differentiate printf() and scanf().

Answer:

Feature	printf()	scanf()
Purpose	Outputs data to screen	Inputs data from keyboard
Direction	Output function	Input function
Format specifier	Required	Required
Parameter	Actual values	Address of variables (&)

Mnemonic: "OIAD: Output-Input, Actual-Destination"

Question 2(b) [4 marks]

Develop a C program to print sum & average of 1 to n.

Answer:

```c
#include <stdio.h>

int main() {
    int n, i, sum = 0;
    float avg;

    printf("Enter n: ");
    scanf("%d", &n);

    for(i = 1; i <= n; i++) {
        sum += i;
    }

    avg = (float)sum / n;

    printf("Sum = %d\n", sum);
    printf("Average = %.2f\n", avg);

    return 0;
}
```

Key Points:

- **Initialization**: sum = 0
- **Iteration**: for loop from 1 to n

- **Type Casting**: (float) for correct average

Mnemonic: "SIAP: Sum Initialize, Add in loop, Print results"

Question 2(c) [7 marks]

Explain Arithmetic operator and Relational operator with example.

Answer:

1. Arithmetic Operators:

Operator	Operation	Example	Result
+	Addition	5 + 3	8
-	Subtraction	5 - 3	2
*	Multiplication	5 * 3	15
/	Division	5 / 2	2 (integer)
%	Modulo (Remainder)	5 % 2	1

2. Relational Operators:

Operator	Meaning	Example	Result
<	Less than	5 < 3	0 (false)
>	Greater than	5 > 3	1 (true)
<=	Less than or equal	5 <= 5	1 (true)
>=	Greater than or equal	3 >= 5	0 (false)
==	Equal to	5 == 5	1 (true)
!=	Not equal to	5 != 3	1 (true)

Code Example:

```c
int a = 5, b = 3;
printf("a + b = %d\n", a + b);      // Output: 8
printf("a > b is %d\n", a > b);     // Output: 1 (true)
```

Mnemonic: "ASMDR for Arithmetic, LEGENE for Relational"

Question 2(a) OR [3 marks]

What is the difference between get(S) and scanf("%s",S)

Answer:

Feature	gets(S)	scanf("%s",S)
Whitespace handling	Reads space	Stops at whitespace
Buffer overflow	No boundary check	Safer with width limit
Return type	char*	Number of items read
Usage safety	Deprecated, unsafe	Safer with format control

Mnemonic: "WBRU: Whitespace-Boundary-Return-Usage"

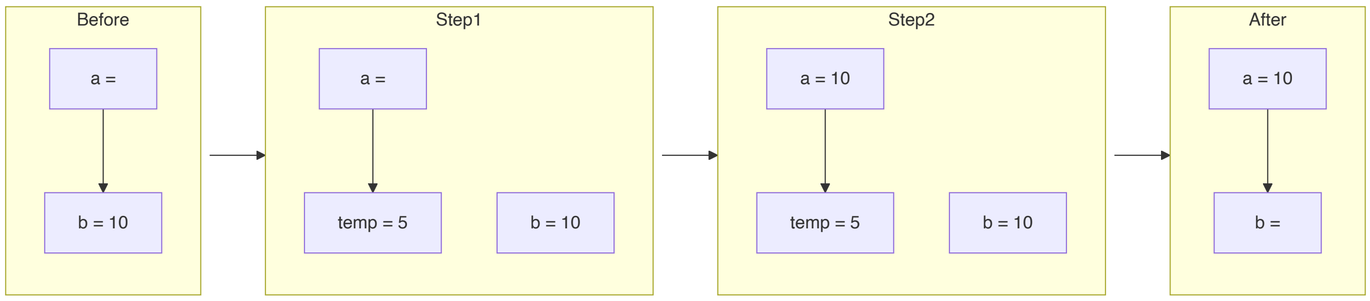
Question 2(b) OR [4 marks]

Develop a C program to swap (exchange) value of two numbers.

Answer:

```c
#include <stdio.h>

int main() {
    int a, b, temp;

    printf("Enter two numbers: ");
    scanf("%d %d", &a, &b);

    printf("Before swap: a = %d, b = %d\n", a, b);

    temp = a;
    a = b;
    b = temp;

    printf("After swap: a = %d, b = %d\n", a, b);

    return 0;
}
```

Diagram:



Mnemonic: "TAB: Temp-Assign-Backfill"

Question 2(c) OR [7 marks]

Explain Boolean operator and Logical operator with example.

Answer:

1. Boolean Operators:

Operator	Operation	Example	Result
&	Bitwise AND	5 & 3	1
|	Bitwise OR	5 | 3	7
^	Bitwise XOR	5 ^ 3	6
~	Bitwise NOT	~5	-6
<<	Left Shift	5 << 1	10
>>	Right Shift	5 >> 1	2

2. Logical Operators:

Operator	Meaning	Example	Result
&&	Logical AND	(5>3) && (2<4)	1 (true)
||	Logical OR	(5<3) || (2<4)	1 (true)
!	Logical NOT	!(5>3)	0 (false)

Example:

```c
int a = 5, b = 3;
printf("a & b = %d\n", a & b);            // Output: 1 (bitwise AND)
printf("a > b && b < 10 is %d\n", a > b && b < 10);  // Output: 1 (true)
```

Bit Representation (5 & 3):

```
5 = 101
3 = 011
& = 001 (1 in decimal)
```

Mnemonic: "BOXNRL for Boolean, AON for Logical"

Question 3(a) [3 marks]

Compare entry controlled and exit controlled loop with example.

Answer:

Feature	Entry Controlled	Exit Controlled
Condition check	Before execution	After execution
Minimum iterations	Zero	One
Example	while, for	do-while
Usage	When pre-check needed	When at least one execution needed

Mnemonic: "BCME: Before-Check-Multiple-Examples"

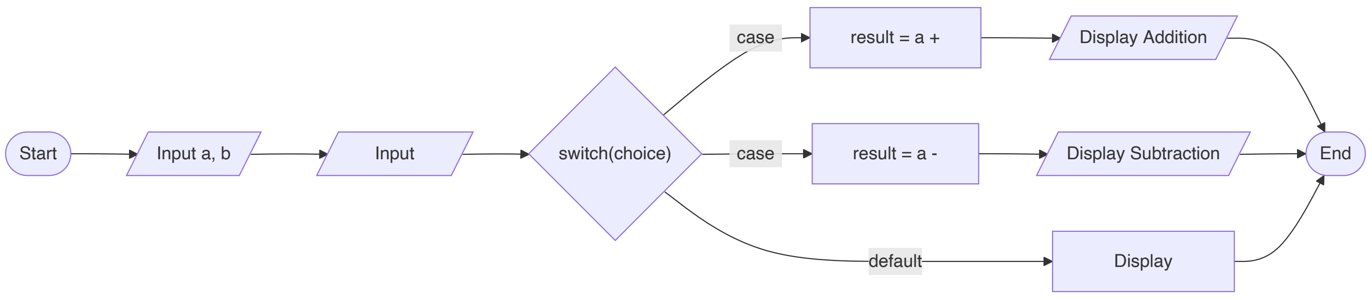
Question 3(b) [4 marks]

Develop a C program to display addition and subtraction of two numbers using switch case.

Answer:

```c
#include <stdio.h>

int main() {
    int a, b, choice, result;

    printf("Enter two numbers: ");
    scanf("%d %d", &a, &b);

    printf("1. Addition\n2. Subtraction\n");
    printf("Enter choice (1/2): ");
    scanf("%d", &choice);

    switch(choice) {
        case 1:
            result = a + b;
            printf("Addition: %d\n", result);
            break;
        case 2:
            result = a - b;
            printf("Subtraction: %d\n", result);
            break;
        default:
            printf("Invalid choice\n");
    }

    return 0;
}
```

Flowchart:



Mnemonic: "CIRCA: Choice-Input-Result-Calculate-Action"

Question 3(c) [7 marks]

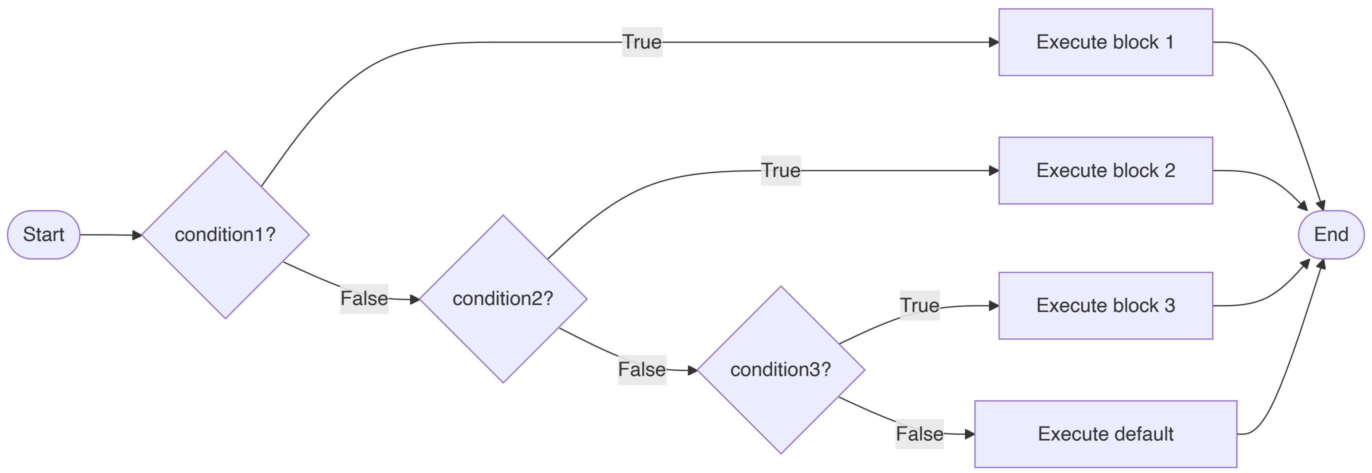
Explain multiple if-else statement with syntax, flowchart and an example.

Answer:

Syntax of multiple if-else:

```
if (condition1) {
    // code block 1
}
else if (condition2) {
    // code block 2
}
else if (condition3) {
    // code block 3
}
else {
    // default code block
}
```

Flowchart:



Example:

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

```c
int main() {
    int marks;

    printf("Enter marks: ");
    scanf("%d", &marks);

    if (marks >= 80) {
        printf("Grade: A\n");
    }
    else if (marks >= 70) {
        printf("Grade: B\n");
    }
    else if (marks >= 60) {
        printf("Grade: C\n");
    }
    else {
        printf("Grade: F\n");
    }

    return 0;
}
```

Mnemonic: "TEST: Try Each Statement Then default"

Question 3(a) OR [3 marks]

State the use of break and continue keyword.

Answer:

Keyword	Purpose	Effect	Common Use
break	Terminates loop/switch	Exits the current loop/switch	To exit when condition met
continue	Skips iteration	Jumps to next iteration	To skip specific values

Example Code:

```c
// break example
for(i=1; i<=10; i++) {
    if(i == 5) break; // exits loop at i=5
    printf("%d ", i);  // prints 1 2 3 4
}

// continue example
for(i=1; i<=5; i++) {
    if(i == 3) continue; // skips i=3
    printf("%d ", i);  // prints 1 2 4 5
}
```

Mnemonic: "EXIT-SKIP: EXit IT or SKIP iteration"

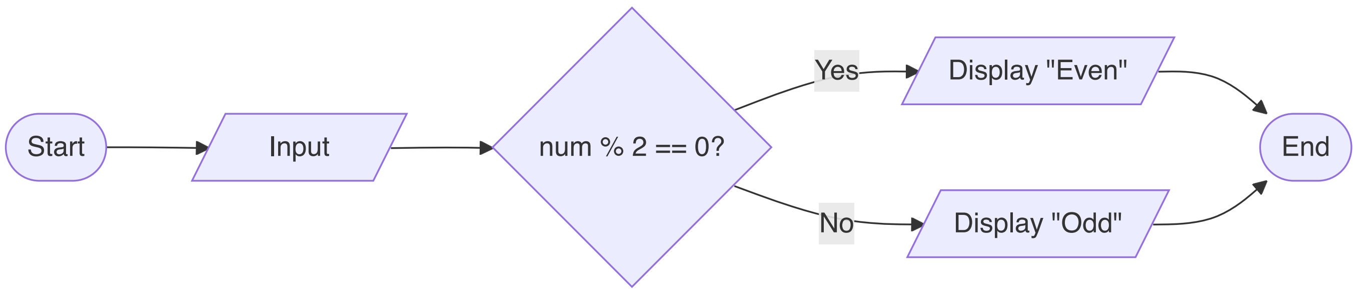
Question 3(b) OR [4 marks]

Develop a C program to check whether the given number is even or odd.

Answer:

```c
#include <stdio.h>

int main() {
    int num;

    printf("Enter a number: ");
    scanf("%d", &num);

    if (num % 2 == 0) {
        printf("%d is even.\n", num);
    }
    else {
        printf("%d is odd.\n", num);
    }

    return 0;
}
```

Diagram:



Key Points:

- **Check**: Using modulo (%) operator
- **Decision**: Based on remainder with 2
- **Output**: Even for remainder 0, Odd otherwise

Mnemonic: "MODE: MODulo Equals zero for even"

Question 3(c) OR [7 marks]

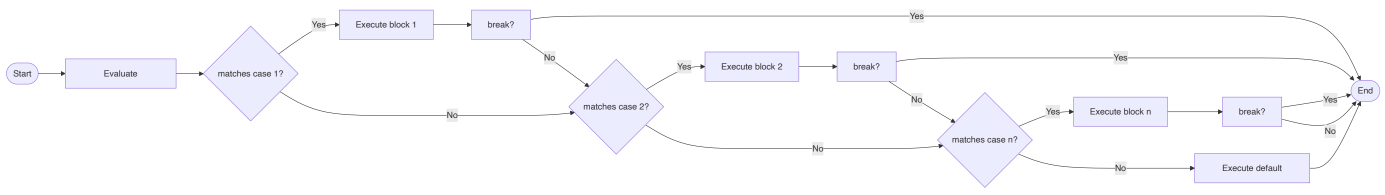
Explain switch-case statement with syntax, flowchart and an example.

Answer:

Syntax of switch-case:

```c
switch (expression) {
    case constant1:
        // code block 1
        break;
    case constant2:
        // code block 2
        break;
    ...
    default:
        // default code block
}
```

Flowchart:



Example:

```c
#include <stdio.h>

int main() {
    char grade;

    printf("Enter grade (A-D): ");
    scanf(" %c", &grade);

    switch (grade) {
        case 'A':
            printf("Excellent!\n");
            break;
        case 'B':
            printf("Good job!\n");
            break;
        case 'C':
            printf("Satisfactory\n");
            break;
        case 'D':
            printf("Needs improvement\n");
            break;
        default:
            printf("Invalid grade\n");
    }

    return 0;
}
```

Mnemonic: "CEBID: Compare-Execute-Break-If-Done"

Question 4(a) [3 marks]

Define string. List out different operations that can be performed on string.

Answer:

String: Array of characters terminated by null character '\0'.

Operation	Description	Function
Input/Output	Read/write strings	gets(), puts()
Copy	Copy one string to another	strcpy()
Concatenation	Join two strings	strcat()
Comparison	Compare two strings	strcmp()
Length	Find string length	strlen()
Search	Find substring	strstr()

Mnemonic: "ICCLS: Input-Copy-Concatenate-Length-Search"

Question 4(b) [4 marks]

Develop a C program to convert uppercase alphabet to lowercase alphabet.

Answer:

```c
#include <stdio.h>

int main() {
    char ch;

    printf("Enter an uppercase letter: ");
    scanf(" %c", &ch);

    if (ch >= 'A' && ch <= 'Z') {
        char lowercase = ch + 32;  // ASCII difference is 32
        printf("Lowercase: %c\n", lowercase);
    }
    else {
        printf("Not an uppercase letter\n");
    }

    return 0;
}
```

ASCII Table Excerpt:

Character	ASCII Value
A	65
a	97
Z	90
z	122
Difference	32

Mnemonic: "COOL: Character Offset Of Lowercase"

Question 4(c) [7 marks]

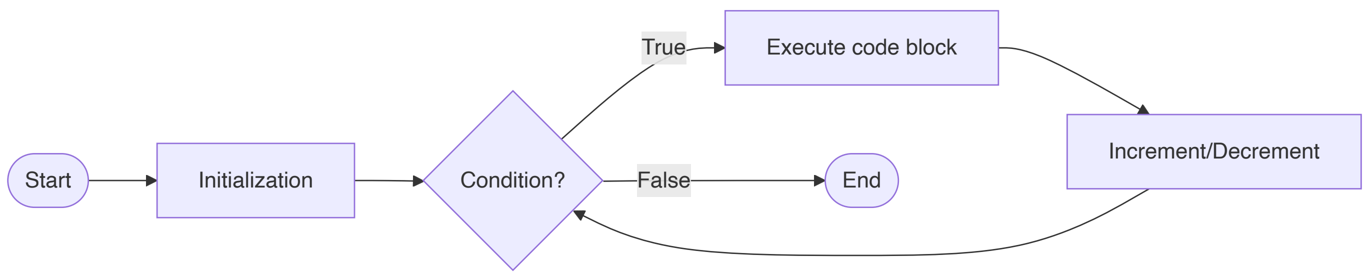
Draw flowchart of for loop and explain with example.

Answer:

For Loop Syntax:

```
for (initialization; condition; increment/decrement) {
    // code block
}
```

Flowchart:



For Loop Components:

1. **Initialization**: Executed once at beginning
2. **Condition**: Checked before each iteration
3. **Increment/Decrement**: Executed after each iteration
4. **Body**: Executed if condition is true

Example:

```c
#include <stdio.h>

int main() {
    int i;

    for (i = 1; i <= 5; i++) {
        printf("%d ", i);
    }
    // Output: 1 2 3 4 5

    return 0;
}
```

Execution Flow:

1. Initialize i = 1
2. Check condition (1 <= 5) - True
3. Execute body - Print 1
4. Increment i to 2
5. Check condition (2 <= 5) - True
6. And so on until i becomes 6

Mnemonic: "ICE-T: Initialize, Check, Execute, Then increment"

Question 4(a) OR [3 marks]

Define array. List out different operations that can be performed on array.

Answer:

Array: Collection of similar data types stored in contiguous memory locations.

Operation	Description	Example
Declaration	Create array	int arr[5];
Initialization	Assign values	arr[0] = 10;
Traversal	Access all elements	for loop
Insertion	Add new element	arr[pos] = value;
Deletion	Remove element	Shift elements
Searching	Find element	Linear/binary search
Sorting	Arrange elements	Bubble/Selection sort

Mnemonic: "DITIDSS: Declare-Initialize-Traverse-Insert-Delete-Search-Sort"

Question 4(b) OR [4 marks]

Define pointer. Explain with example.

Answer:

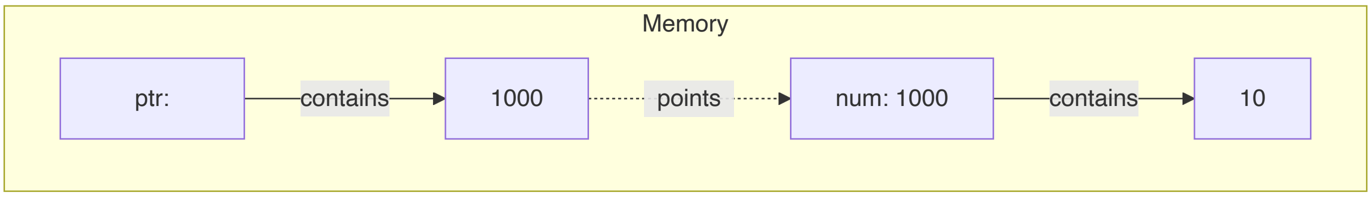
Pointer: Variable that stores the memory address of another variable.

Concept	Description	Syntax
Declaration	Create pointer	int *ptr;
Address operator	Get address	&variable
Dereferencing	Access value at address	*ptr
Assignment	Store address in pointer	ptr = &variable;

Example:

```
#include <stdio.h>

int main() {
    int num = 10;
    int *ptr;

    ptr = &num;  // Store address of num in ptr

    printf("Value of num: %d\n", num);           // 10
    printf("Address of num: %p\n", &num);        // Address of num
    printf("Value of ptr: %p\n", ptr);           // Same address
    printf("Value pointed by ptr: %d\n", *ptr);  // 10

    *ptr = 20;    // Change value using pointer
    printf("New value of num: %d\n", num);       // 20

    return 0;
}
```

Diagram:



Mnemonic: "SAVD: Store Address, Value through Dereferencing"

Question 4(c) OR [7 marks]

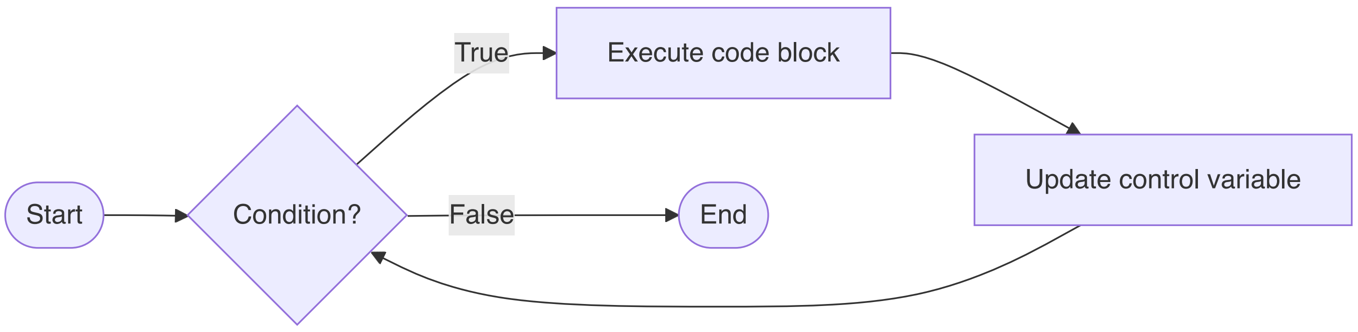
Draw flowchart of while loop and explain with example.

Answer:

While Loop Syntax:

```c
while (condition) {
    // code block
}
```

Flowchart:



While Loop Components:

1. **Initialization**: Before the loop
2. **Condition**: Checked before each iteration
3. **Body**: Executed if condition is true
4. **Update**: Must be done inside the body

Example:

```c
#include <stdio.h>

int main() {
    int i = 1;

    while (i <= 5) {
        printf("%d ", i);
        i++;
    }
    // Output: 1 2 3 4 5

    return 0;
}
```

Execution Flow:

1. Initialize i = 1 (before loop)
2. Check condition (1 <= 5) - True

3. Execute body - Print 1
4. Update i to 2
5. Check condition (2 <= 5) - True
6. And so on until i becomes 6

Mnemonic: "CHECK-UPDATE: CHECK before entering, UPDATE before repeating"

Question 5(a) [3 marks]

State the use of following functions. (1) strcat() (2) strlen() (3) strcpy()

Answer:

Function	Purpose	Syntax	Example
strcat()	Concatenates strings	strcat(dest, src)	"Hello" + "World" -> "HelloWorld"
strlen()	Returns string length	strlen(str)	"Hello" -> 5
strcpy()	Copies string	strcpy(dest, src)	src -> dest

Code Example:

```
#include <string.h>

char str1[20] = "Hello";
char str2[20] = "World";
char str3[20];

strcat(str1, str2);    // str1 becomes "HelloWorld"
int len = strlen(str1); // len becomes 10
strcpy(str3, str1);    // str3 becomes "HelloWorld"
```

Mnemonic: "CLS: Concatenate-Length-Source copy"

Question 5(b) [4 marks]

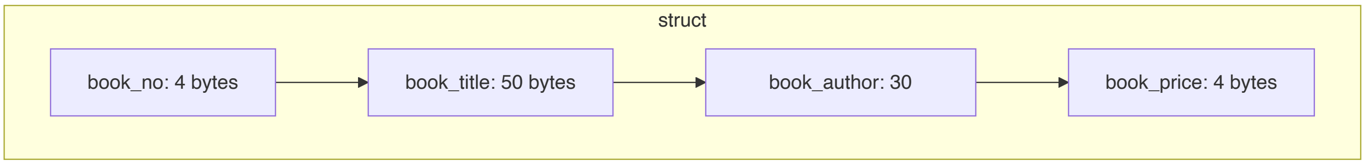
Build a structure to store book information: book_no, book_title, book_author, book_price.

Answer:

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

struct Book {
    int book_no;
    char book_title[50];
    char book_author[30];
    float book_price;
};
```

```c
int main() {
    struct Book book1;

    // Assign values
    book1.book_no = 101;
    strcpy(book1.book_title, "Programming in C");
    strcpy(book1.book_author, "Dennis Ritchie");
    book1.book_price = 450.75;

    // Display book information
    printf("Book No: %d\n", book1.book_no);
    printf("Title: %s\n", book1.book_title);
    printf("Author: %s\n", book1.book_author);
    printf("Price: %.2f\n", book1.book_price);

    return 0;
}
```

Structure Memory Layout:



Mnemonic: "NTAP: Number-Title-Author-Price"

Question 5(c) [7 marks]

Explain array and array initialization. Give example.

Answer:

Array: Collection of same data type elements stored at contiguous memory locations.

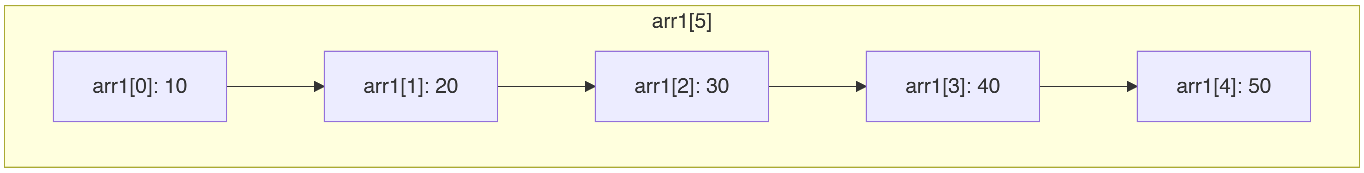
Array Initialization Methods:

Method	Syntax	Example
At declaration	datatype array_name[size] = {values};	int arr[5] = {10, 20, 30, 40, 50};
Partial	datatype array_name[size] = {values};	int arr[5] = {10, 20}; // Rest are 0
All zeros	datatype array_name[size] = {0};	int arr[5] = {0};
Element by element	array_name[index] = value;	arr[0] = 10; arr[1] = 20;
Size inference	datatype array_name[] = {values};	int arr[] = {10, 20, 30}; // Size 3

Example:

```c
#include <stdio.h>

int main() {
    // Method 1: Complete initialization
    int arr1[5] = {10, 20, 30, 40, 50};

    // Method 2: Partial initialization (remaining elements set to 0)
    int arr2[5] = {10, 20};  // arr2[2], arr2[3], arr2[4] become 0

    // Method 3: Element by element
    int arr3[3];
    arr3[0] = 100;
    arr3[1] = 200;
    arr3[2] = 300;

    // Method 4: Size inference
    int arr4[] = {1, 2, 3, 4, 5};  // Size automatically set to 5

    // Accessing elements
    printf("arr1[2] = %d\n", arr1[2]);  // Output: 30

    // Array traversal
    printf("arr4 elements: ");
    for(int i = 0; i < 5; i++) {
        printf("%d ", arr4[i]);  // Output: 1 2 3 4 5
    }

    return 0;
}
```

Memory Representation:



Mnemonic: "CAPES: Complete, Automatic, Partial, Element, Size-inferred"

Question 5(a) OR [3 marks]

Compare array and structure with example.

Answer:

Feature	Array	Structure
Data type	Same type elements	Different type elements
Access	Using index (arr[i])	Using dot operator (s.member)
Memory	Contiguous, fixed size	Contiguous, may have padding
Assignment	Element by element	Direct with compatible structures
Purpose	Collection of similar items	Group of related data

Array Example:

```c
int marks[5] = {85, 90, 78, 92, 88};
printf("%d", marks[2]);  // Access element at index 2 (78)
```

Structure Example:

```c
struct Student {
    int roll_no;
    char name[20];
    float percentage;
};

struct Student s1 = {101, "Raj", 85.5};
printf("%s", s1.name);  // Access name member ("Raj")
```

Mnemonic: "DAMPA: Datatype-Access-Memory-Purpose-Assignment"

Question 5(b) OR [4 marks]

Define User Defined Function. Explain with example.

Answer:

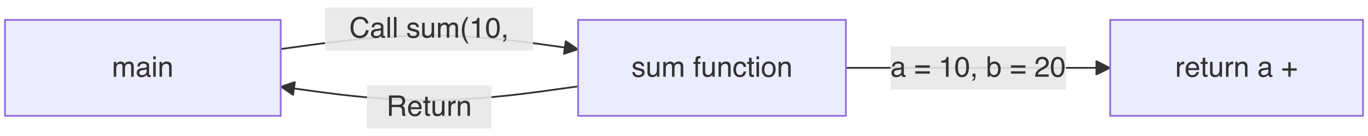
User Defined Function: Block of code written by programmer to perform specific task, which can be called multiple times.

Component	Description	Example
Return type	Data type returned	int, float, void
Function name	Unique identifier	sum, findMax
Parameters	Input data	(int a, int b)
Body	Set of statements	{ return a+b; }

Example:

```
#include <stdio.h>

// Function declaration
int sum(int a, int b);

int main() {
    int num1 = 10, num2 = 20, result;

    // Function call
    result = sum(num1, num2);

    printf("Sum = %d\n", result);

    return 0;
}

// Function definition
int sum(int a, int b) {
    return a + b;
}
```

Function Flow:



Mnemonic: "DPCR: Declaration-Parameters-Call-Return"

Question 5(c) OR [7 marks]

Develop a C program to find maximum and minimum element of array.

Answer:

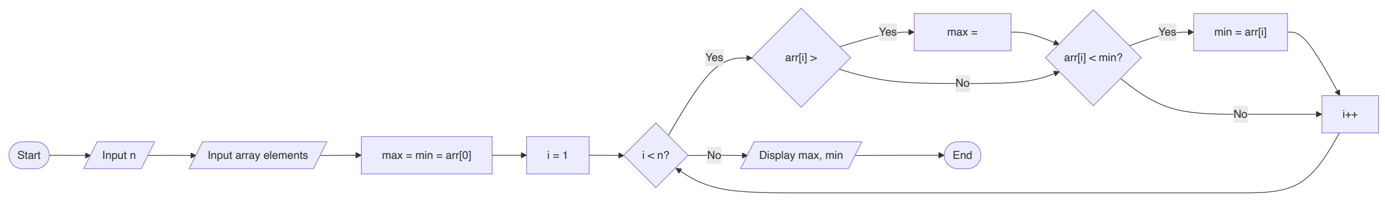
```
#include <stdio.h>

int main() {
    int arr[100], n, i;
    int max, min;

    printf("Enter number of elements: ");
    scanf("%d", &n);

    printf("Enter %d integers: ", n);
    for(i = 0; i < n; i++) {
        scanf("%d", &arr[i]);
    }

    // Initialize max and min with first element
    max = min = arr[0];
```

```c
    // Find max and min
    for(i = 1; i < n; i++) {
        if(arr[i] > max) {
            max = arr[i];
        }
        if(arr[i] < min) {
            min = arr[i];
        }
    }

    printf("Maximum element: %d\n", max);
    printf("Minimum element: %d\n", min);

    return 0;
}
```

Algorithm:

1. Input array size and elements
2. Initialize max and min with first element
3. For each remaining element:
    - If element > max, update max
    - If element < min, update min
4. Display max and min

Flowchart:



Mnemonic: "FILLS: First Initialize, Loop through, Look for Small/large"