

4. Decision Making and Looping

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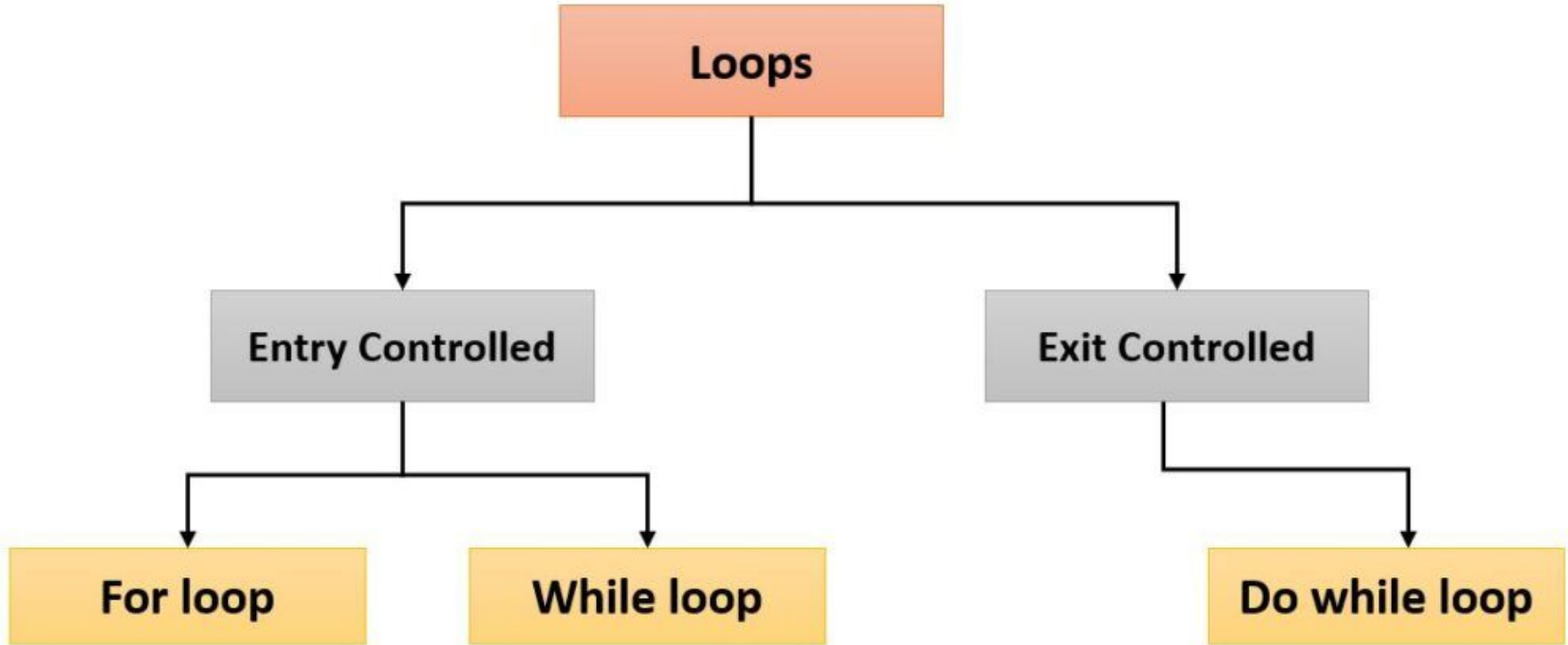
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1. Introduction: Decision Making & Looping

- ❑ Looping allows programs to execute a block of code repeatedly. This is essential for processing collections of data, performing repetitive tasks, and creating interactive programs.
- ❑ **Why loops?**
 - ❑ Avoid writing repeated code
 - ❑ Reduce program size
 - ❑ Improve readability

1. Introduction: Decision Making & Looping



2.The FOR Statement

Compact loop structure with initialization, condition, and update all in one line.
Best for known number of iterations.

- Entry-controlled loop
- Most compact loop
- Used when number of iterations is known

Syntax:

```
c

for (initialization; condition; update) {
    // code to repeat
}
```

Example

```
c

#include <stdio.h>

int main() {
    int i;

    for (i = 1; i <= 5; i++) {
        printf("%d ", i);
    }
    return 0;
}
```

✓ Output:

```
1 2 3 4 5
```

3. The WHILE Statement

Executes a block of code as long as a condition is true. It's a pre-test loop (condition checked before execution).

- **Entry-controlled loop**
- Condition is checked **before** execution
- Loop may execute **zero or more times**

Syntax:

```
c

while (condition) {
    // code to repeat
    // update condition variable
}
```

Example

```
c

#include <stdio.h>

int main() {
    int i = 1;

    while (i <= 5) {
        printf("%d ", i);
        i++;
    }
    return 0;
}
```

✓ Output:

1 2 3 4 5

4. The DO Statement

Executes the block at least once, then repeats while condition is true. It's a post-test loop (condition checked after execution).

- **Exit-controlled loop**
- Condition is checked **after** execution
- Loop executes **at least once**

Syntax:

```
c

do {
    // code to repeat
    // update condition variable
} while (condition);
```

Example

```
c

#include <stdio.h>

int main() {
    int i = 1;

    do {
        printf("%d ", i);
        i++;
    } while (i <= 5);

    return 0;
}
```

✓ Output:

1 2 3 4 5

5. Jumps in Loops

Jump statements change normal loop execution. Some statements used to jump in the loop:

- breaks
- continue
- goto

These special statements to alter normal loop flow.

5.1 break statement

Terminates the loop immediately i.e. immediately exits the loop.

```
for (int i = 1; i <= 5; i++) {  
    if (i == 3)  
        break;  
    printf("%d ", i);  
}
```

✓ Output:

```
1 2
```

5.2 continue statement

Skips current iteration and moves to next.

```
for (int i = 1; i <= 5; i++) {  
    if (i == 3)  
        continue;  
    printf("%d ", i);  
}
```

✓ Output:

1 2 4 5

5.3 goto statement

Transfers control unconditionally to a labeled statement.

```
1  #include<stdio.h>
2
3  int main()
4  {
5      int i = 1;
6
7      while (i <= 5)
8      {
9          printf("%d ", i);
10         i++;
11         if (i == 3)
12         {
13             goto another;
14         }
15     }
16     another:
17         printf("\nafter 2 no value will be displayed!!");
18
19     return 0;
20 }
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL

```
1 2
after 2 no value will be displayed!!
```

6. Concise Test Expressions

Using **shorter forms of conditions** where non-zero means true. In that case, zero is treated as false and any non-zero value is treated as true, allowing conditions to be written in concise form.

a)

Long form

```
c
while (i != 0) {
    printf("%d ", i);
    i--;
}
```

Short form

```
c
while (i) {
    printf("%d ", i);
    i--;
}
```

Same meaning, shorter and cleaner.

b)

```
if (!x)
    printf("x is zero");
```

- `!x` → TRUE when `x == 0`

c)

Using `for` without body

```
c
for (i = 0; i < n; sum += i++);
```

Summary

Comparison Table: Loop Types

Loop Type	When to Use	Example Scenario	Entry Condition Check
WHILE	Unknown iterations, condition-based	User input validation	Before execution
DO-WHILE	At least one execution needed	Menu systems	After execution
FOR	Known iterations, counter-based	Array processing, patterns	Before execution

*END
of
Chapter 4*

Reference: E. Balaguruswamy; Programming in ANSI C; *chapter-6*;