BASIC PROGRAMMING

CONTROL FLOW: LOOPS

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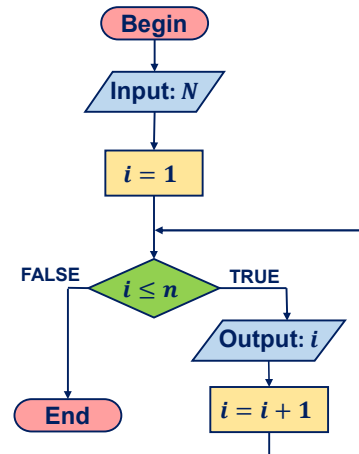# CONTENTS

- Loops – While

- Loops – For

- Loop – Do-while

- Break & Continue

- Goto & Labels
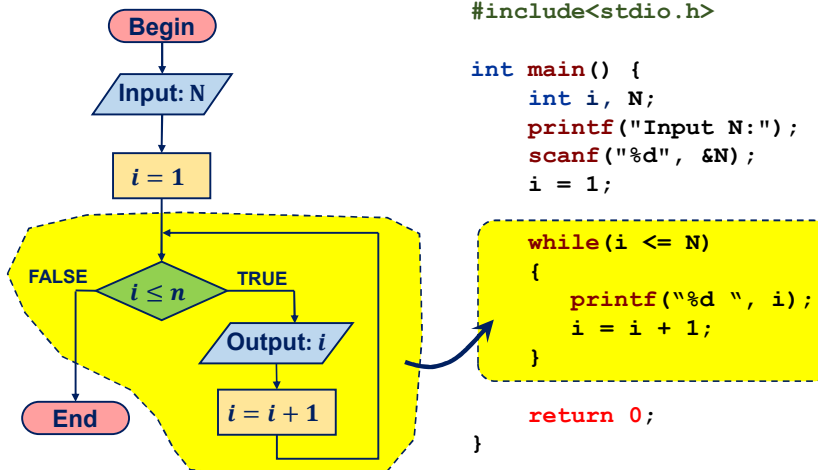
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LOOPS

- Given N, output the list of N integers

Begin
Input: N
$i = 1$
FALSE $i \leq n$ TRUE
Output: i
End
$i = i + 1$

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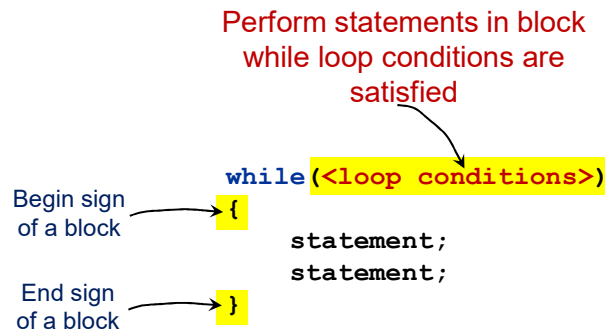
LOOPS – WHILE

- Given N, output the list of N integers

Begin
Input: N
$i = 1$
FALSE $i \leq n$ TRUE
Output: i
End
$i = i + 1$

```c
#include<stdio.h>

int main() {
    int i, N;
    printf("Input N:");
    scanf("%d", &N);
    i = 1;

    while(i <= N)
    {
        printf("%d ", i);
        i = i + 1;
    }

    return 0;
}
```

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LOOPS – WHILE

• Syntax:

Perform statements in block
while loop conditions are
satisfied

```
while(<loop conditions>)
{
    statement;
    statement;
}
```

Begin sign
of a block

End sign
of a block

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LOOPS – WHILE

• Exercises: Write C program to

1. Compute the sum of N first integers $S = 1 + 2 + \cdots + N$
2. Compute the sum of N first <u>even</u> integers $S = 2 + 4 + \cdots + 2N$
3. Given an integer N, list all of its divisors. E.g., divisors of $N = 12$ are 1 2 3 4 6 12
4. Given an integer N, count the number of its divisors. E.g., the number of divisors of $N = 12$ is 6
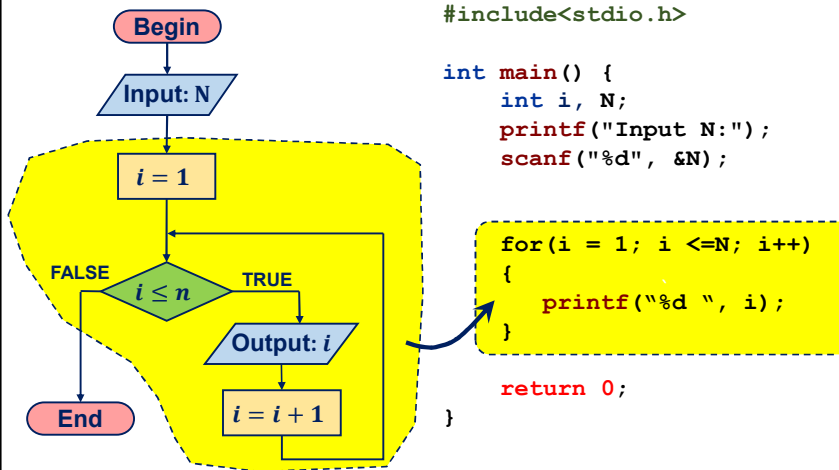
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LOOPS – FOR

- Given N, output the list of N integers

Begin

Input: N

$i = 1$

FALSE $\quad i \leq n \quad$ **TRUE**

Output: i

End $\qquad i = i + 1$

```
#include<stdio.h>

int main() {
    int i, N;
    printf("Input N:");
    scanf("%d", &N);

    for(i = 1; i <=N; i++)
    {
        printf("%d ", i);
    }

    return 0;
}
```

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LOOPS – FOR

- Syntax:

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1 This step is firstly executed. Only once

Perform statements in block while loop conditions are satisfied

```
for(<initial>;<loop conditions>;<increment>)
{
    statement;
    statement;
}
```

Begin sign of a block → **{**

End sign of a block → **}**

Jumps back up here after for body is finished

3
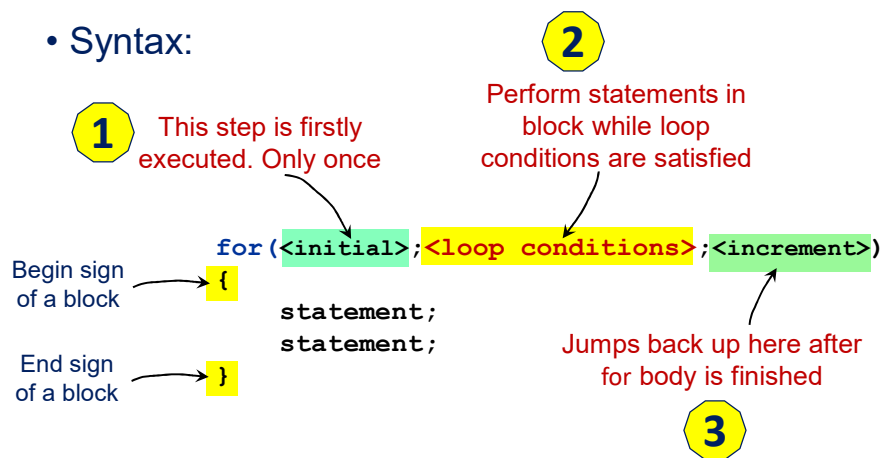
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LOOPS – FOR

- Exercises: Write C program to
  1. Compute the sum of N first integers $S = 1 + 2 + \cdots + N$
  2. Compute the sum of N first <u>even</u> integers $S = 2 + 4 + \cdots + 2N$
  3. Given an integer N, list all of its divisors. E.g., divisors of $N = 12$ are 1 2 3 4 6 12
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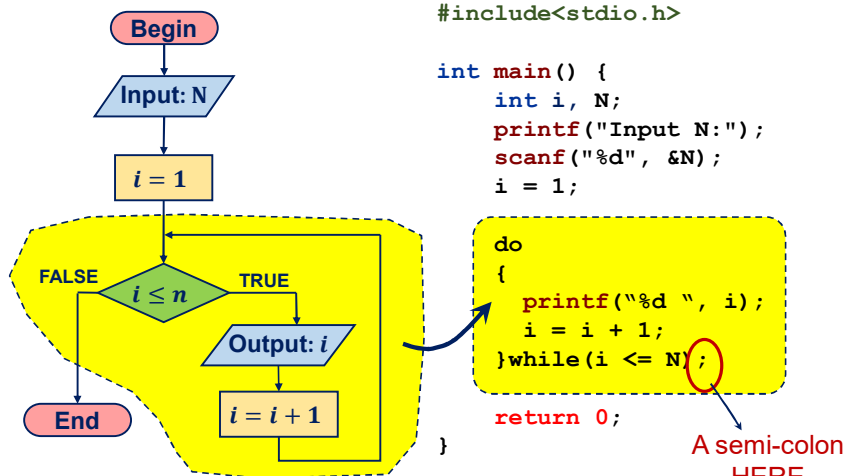
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LOOPS – DO WHILE

- Given N, output the list of N integers


```c
#include<stdio.h>

int main() {
    int i, N;
    printf("Input N:");
    scanf("%d", &N);
    i = 1;

    do
    {
        printf("%d ", i);
        i = i + 1;
    }while(i <= N);

    return 0;
}
```

A semi-colon HERE

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LOOPS – DO WHILE

• Syntax:

```
          do
Begin sign    {
of a block
              statement;
              statement;
End sign    } while(<loop conditions>) ;
of a block
```

A semi-colon HERE

Perform statements in block while loop conditions are satisfied
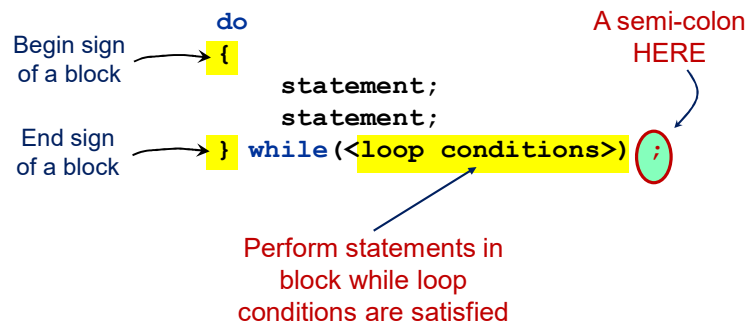
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LOOPS – DO WHILE

• Exercises: Write C program to

1. Compute the sum of N first integers $S = 1 + 2 + \cdots + N$
2. Compute the sum of N first <u>even</u> integers $S = 2 + 4 + \cdots + 2N$
3. Given an integer N, list all of its divisors. E.g., divisors of $N = 12$ are 1 2 3 4 6 12
4. Given an integer N, count the number of its divisors. E.g., the number of divisors of $N = 12$ is 6

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LOOPS – COMMENTS

- What are differences among three loops?

- Which one should we use?

- Can we use break in loop? If YES, what will happens?

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LOOPS – COMMENTS

- Please read in your textbook:
  - continue
  - label & goto

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LOOPS – Exercises

- Exercises: Write C program to

1. Given an integer N, sum up all its divisors. E.g., sum of all divisors of $N = 12$ is 28

2. Given an integer N, e.g., $N = 128$

   - How many digits in N? E.g., 3

   - What is its last digit? E.g., 8

   - What is its first digit? E.g., 1

   - Compute the sum of all digits in N. E.g., sum $= 11$

   - Find the integer which is the reverse of N. E.g., 821

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LOOPS – Exercises

- Exercises: Write C program to

3. Check if a given integer N is a prime number.

4. Given integer n, compute:

   a. $S = 1^2 + 2^2 + \cdots + n^2$

   b. $S = 1 + \frac{1}{2} + \cdots + \frac{1}{n}$

   c. $S = \frac{1}{2} + \frac{2}{3} + \cdots + \frac{n}{n+1}$

   d. $T = 1 \times 2 \times \cdots \times n$

   e. $S = 1! + 2! + \cdots + n!$

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Any Questions?

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