Python Basics, Programming Fundamentals, and Introduction to Numerical Linear Algebra

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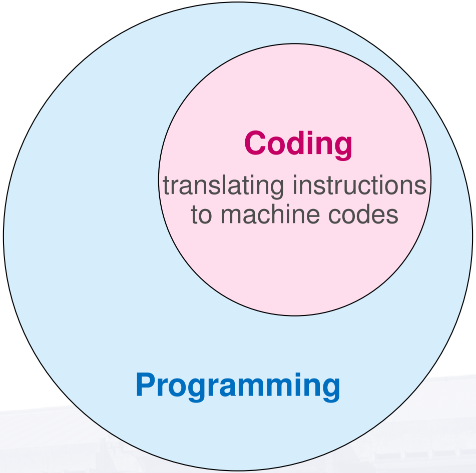
Programming vs Coding



Coding

translating instructions
to machine codes

Programming

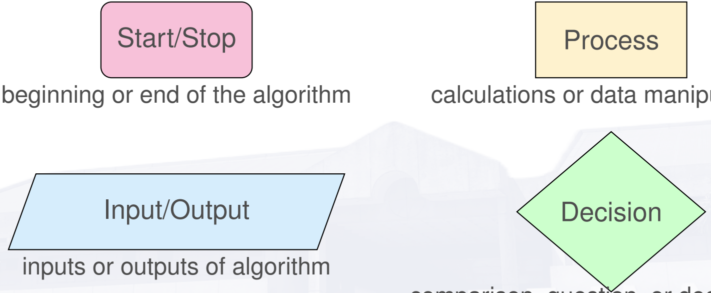
- creating and developing an executable machine program
- debugging and testing
- documentation review and analysis

Algorithm

Algorithm is a procedure that describes, in unambiguous manner, a finite sequence of steps to be performed in a specified order

- presented in natural language, NOT programming language

- To describe an algorithm:
  - pseudocode uses code-like statements
  - flowchart is a visual or graphical representation



beginning or end of the algorithm

calculations or data manipulations

inputs or outputs of algorithm

comparison, question, or decision that determines alternative paths to be followed

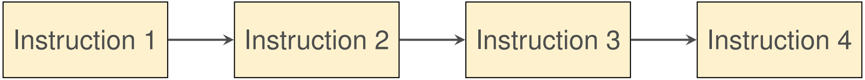
Use: arrows to represent the flow of logic

Control Structure

Control structures change the order that statements are executed or decide if a certain statement will be run

Fundamental control structures:

- Sequence expresses the trivial idea that unless you direct it otherwise, the computer code is to be implemented one instruction at a time



Instruction 1

Instruction 2

Instruction 3

Instruction 4

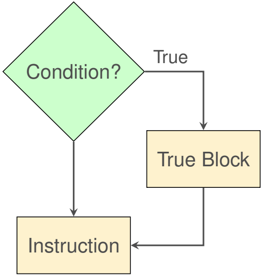
- Selection provides a means to split the flow into branches based on the outcome of a logical condition
- Repetition provides a means to implement instructions repeatedly

Selection

- Single-alternative decision

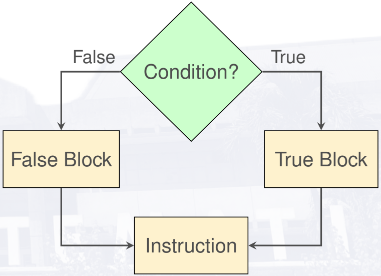
```
if condition :
    TRUE block
```

```
if condition1 :
    Block1
    if condition2 :
        Block2
```



- Double-alternative decision

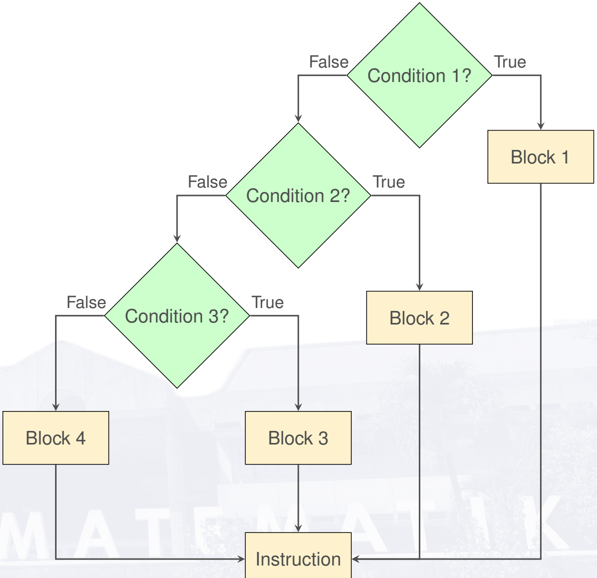
```
if condition :
    TRUE block
else:
    FALSE block
```



Selection

- Multialternative decision

```
if condition1 :
    Block 1
elif condition2 :
    Block 2
elif condition3 :
    Block 3
else:
    Block 4
```



Repetition

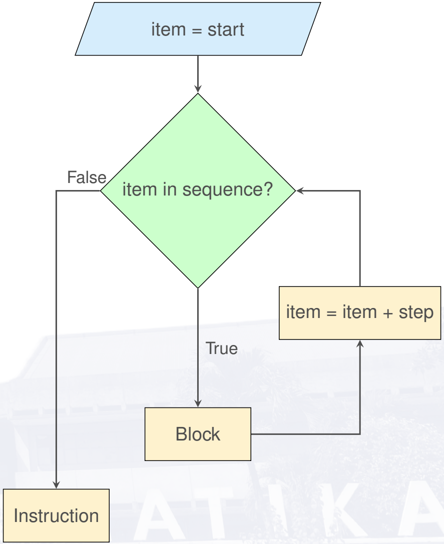
- Count-controlled loop performs a specified number of repetitions or iterations

```
for item in sequence:
    Block
```

```
for i in range(8):
    print(i)
```

```
for i in range(3,8):
    print(i)
```

```
for i in range(3,10,2):
    print(i)
```

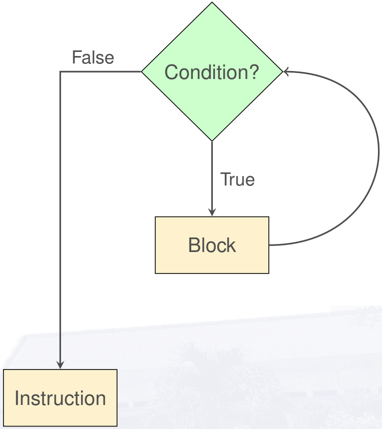


Repetition

- Decision loop terminates based on the result of a logical condition

```python
while condition :
    Block
```

```python
count = 0
while count < 10 :
    count += 1
    print(count)
print("End")
```

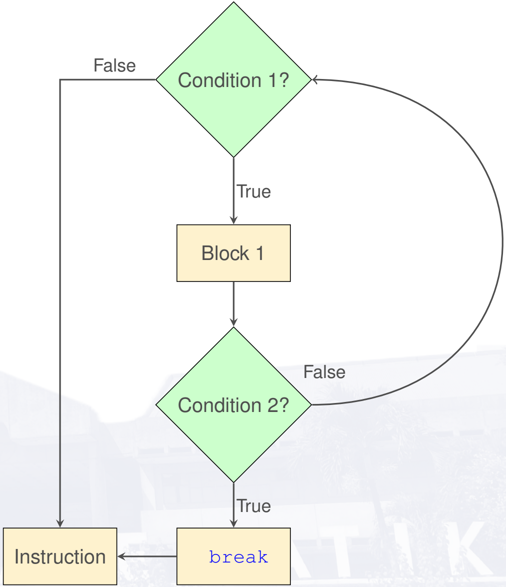


```python
while 1 == 1:
   print("Help, I’m stuck in a loop.")
```

break

- ”breaks out” of the loop
- terminates the loop immediately when it is encountered
- used with decision making statement, such as `if`

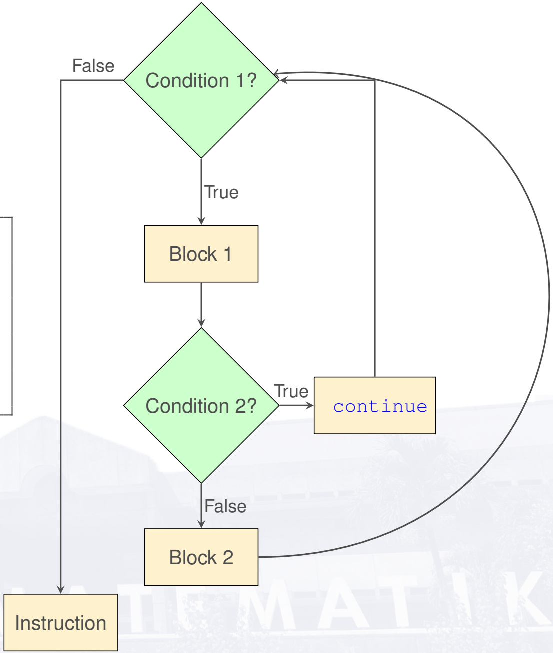
```
while condition1 :
    Block 1
    if condition2 :
        break
Block 2
```



continue

- skips some statements inside the loop
- used with decision-making statement, such as `if`

```
while condition1 :
    Block 1
    if condition2 :
        continue
    Block 2
```



break vs continue

break

```python
var = 10

while var > 0:
    var -= 1
    if var == 5:
        break
    print(var)

print("Goodbye!")
```

continue

```python
var = 10

while var > 0:
    var -= 1
    if var == 5:
        continue
    print(var)

print("Goodbye!")
```

Thank you for your attention!