Functions and Modular Programming (in Python)

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Imperative

```
1 sum = 0
2 for x in my_list:
3    sum += x
4 print(sum)
```

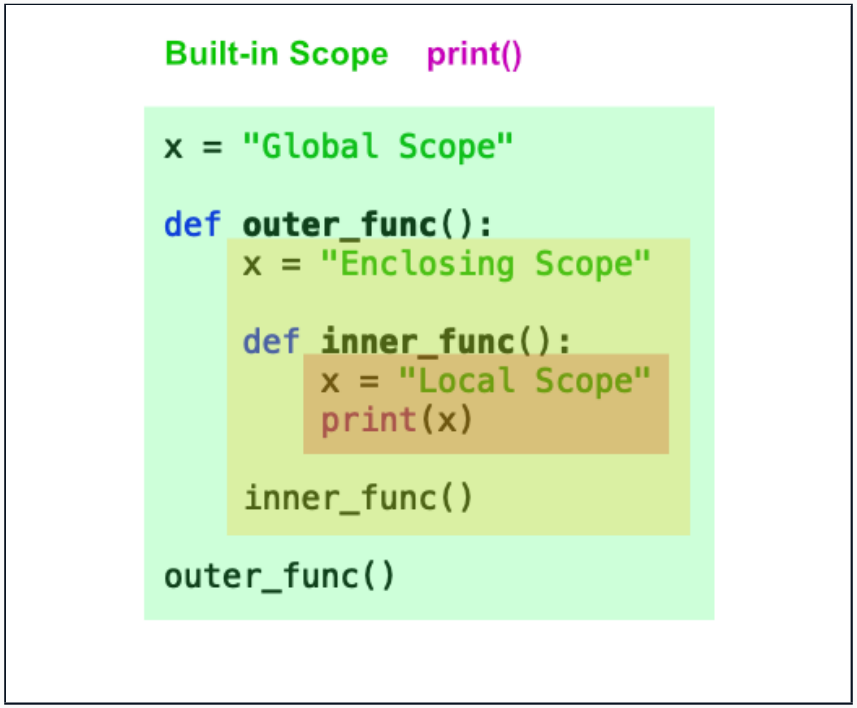
Programming with an explicit sequence of commands that update state.

Procedural

```
1 def do_add(any_list):
2    sum = 0
3    for x in any_list:
4       sum += x
5    return sum
6
7 print(do_add(my_list))
```

Imperative programming with procedure calls.

Variable scope

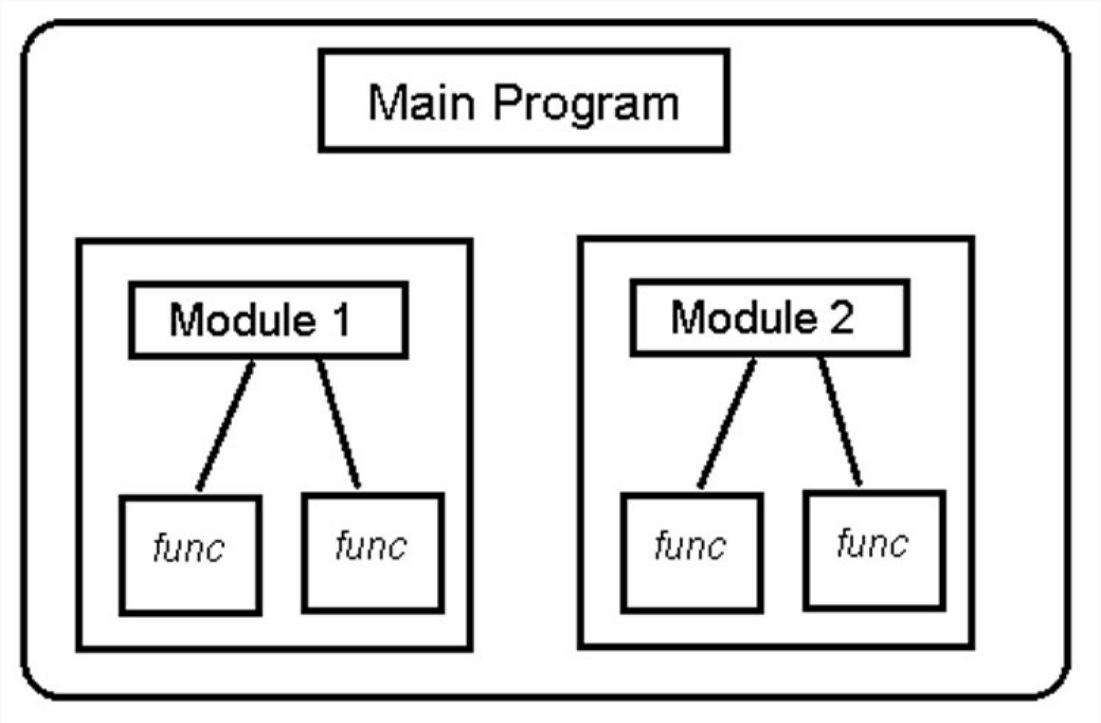


Scope: regions of a program that deine the visibility of variables

Global variables reduces the modularity and flexibility of the program! You avoid global variable by passing variables to function arguments.

Modularity

Modularization reduces software complexity and facilitates re-usability



Modular programming breaks the code into parts that can be shared across projects and modified independently

CT Example

Problem `12A4BA78AB11A1314AB`

Decomposition:

- Two types of data, numbers and letters
- Numbers (`int`) are in ascending order
- Letters only `A`, `B`, `AB`
- `AB` only occurs in the end

Pattern recognition:

- `A` in 3^{rd} positions
- `B` in 5^{th} positions
- Numbers are positional values (index)

CT Example

Validate:

x_i	1	2	A	4	B	A	7	8	A	B	11	A	13	14	AB
i	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Design (possible) solution

```
1  def solution(n):
2     result = ''
3     for i in range(1, n + 1, 1):
4        if i == n:
5           result += 'AB'
6        elif i % 3 == 0:
7           result += 'A'
8        elif i % 5 == 0:
9           result += 'B'
10       else:
11          result += str(i)
12    return result
```

CT 'scalable' Solution

```
1  def solution(n):
2      result = str()
3      for i in range(1, n + 1, 1):
4          if (i % 3 == 0) and (i % 5 == 0):
5              result += 'AB'
6          elif i % 3 == 0:
7              result += 'A'
8          elif i % 5 == 0:
9              result += 'B'
10         else:
11             result += str(i)
12     return result
```

CT 'if' Solution

```
1  def solution(n):
2      result = str()
3      for i in range(1, n + 1, 1):
4          flag = False
5          if i % 3 == 0:
6              result += 'A'
7              flag = True
8          if i % 5 == 0:
9              result += 'B'
10             flag = True
11         if flag == False:
12             result += str(i)
13     return result
```

```
1 if questions:
2     try:
3         answer()
4     except RunTimeError:
5         pass
6     else:
7         print('break')
```