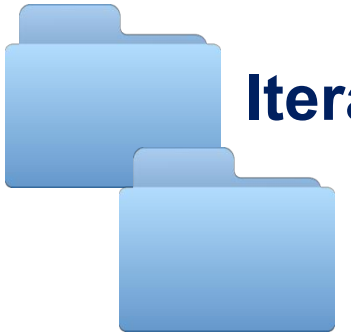
Pattern Recognition in Python

Lesson Objectives

At the end of this lesson, you should be able to:

- Recognize similar patterns in problems
- Apply pattern recognition in Python programming language

Topic Outline



Iterative Accumulation

Practices on Pattern Recognition

Iterative Accumulation

Iterative Accumulation is a very common operation.

It accumulates **target values** iteratively.

Iterative Accumulation: Example

How to calculate the result of

1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10?

Target values in each iteration:

- Iteration 1: 1
- Iteration 2: 2
- Iteration 3: 3
  - •
  - •
  - •
- Iteration 10: 10

accumulate → **55**

Iterative Accumulation: Python Code

Three Important Elements

result variable
(to store the accumulation result)

```
n = 10
result = 0

for i in range(1,n+1):
    result = result + i

print(result)
```

for loop

target value
(in each iteration)

Problem 1

How to calculate the result of

1/1 + 1/2 + 1/3 + 1/4 + 1/5 + 1/6 + 1/7 + 1/8 + 1/9 + 1/10?

Target values in each iteration:

- Iteration 1: 1/1
- Iteration 2: 1/2
- Iteration 3: 1/3

generalize → **Iteration i: 1/i**

- ⋮
- Iteration 10: 1/10

Problem 1: Python Code

How to calculate the result of

1/1 + 1/2 + 1/3 + 1/4 + 1/5 + 1/6 + 1/7 + 1/8 + 1/9 + 1/10?

Three Important Elements

- result variable
- `for` loop
- target value

Iteration i: 1/i

```
n = 10
result = 0

for i in range(1,n+1):
    result = result + 1/i

print(result)
```

Problem 2

How to calculate the result of

1/(1*2) + 1/(2*3) + 1/(3*4) + 1/(4*5) + 1/(5*6) + 1/(6*7) + 1/(7*8) + 1/(8*9) + 1/(9*10) + 1/(10*11)?

Target values in each iteration:

- Iteration 1: 1/(1*2)
- Iteration 2: 1/(2*3)
- Iteration 3: 1/(3*4)
  - •
  - •
  - •
- Iteration 10: 1/(10*11)

generalize → **Iteration i: 1/(i*(i+1))**

Problem 2: Python Code

How to calculate the result of

1/(1*2) + 1/(2*3) + 1/(3*4) + 1/(4*5) + 1/(5*6) + 1/(6*7) + 1/(7*8) + 1/(8*9) + 1/(9*10) + 1/(10*11)?

Three Important Elements

- result variable
- `for` loop
- target value

Iteration i: 1/(i*(i+1))

```
n = 10
result = 0

for i in range(1,n+1):
    result = result + 1/(i*(i+1))

print(result)
```

Problem 3

How to calculate the result of

0/1 + 1/2 + 2/3 + 3/4 + 4/5 + 5/6 + 6/7 + 7/8 + 8/9 + 9/10?

Target values in each iteration:

- Iteration 1: 0/1
- Iteration 2: 1/2
- Iteration 3: 2/3

generalize

Iteration i: (i-1)/i

- Iteration 10: 9/10

Problem 3: Python Code

How to calculate the result of

0/1 + 1/2 + 2/3 + 3/4 + 4/5 + 5/6 + 6/7 + 7/8 + 8/9 + 9/10?

Three Important Elements

- result variable
- `for` loop
- target value

Iteration i: (i-1)/i

```
n = 10
result = 0

for i in range(1,n+1):
    result = result + (i-1)/i

print(result)
```

Problem 4

How to calculate the result of

1/9 + 2/8 + 3/7 + 4/6 + 5/5 + 6/4 + 7/3 + 8/2 + 9/1?

Target values in each iteration:

- Iteration 1: 1/9
- Iteration 2: 2/8
- Iteration 3: 3/7

generalize

Iteration i: i/(10-i)

- Iteration 9: 9/1

Problem 4: Python Code

How to calculate the result of

1/9 + 2/8 + 3/7 + 4/6 + 5/5 + 6/4 + 7/3 + 8/2 + 9/1?

Three Important Elements

- result variable
- `for` loop
- target value

Iteration i: i/(10-i)

```
n = 9
result = 0

for i in range(1,n+1):
    result = result + i/(10-i)

print(result)
```

Problem 5

How to calculate the result of

3/5 + 4/6 + 5/7 + 6/8 + 7/9 + 8/10 + 9/11 + 10/12 + 11/13 + 12/14?

Target values in each iteration:

- Iteration 1: 3/5
- Iteration 2: 4/6
- Iteration 3: 5/7

Iteration i: (i+2)/(i+4)

- Iteration 10: 12/14

Problem 5: Python Code

How to calculate the result of

3/5 + 4/6 + 5/7 + 6/8 + 7/9 + 8/10 + 9/11 + 10/12 + 11/13 + 12/14?

Three Important Elements

- result variable
- `for` loop
- target value

Iteration i: (i+2)/(i+4)

```
n = 10
result = 0

for i in range(1,n+1):
    result = result + (i+2)/(i+4)

print(result)
```

Problem 6

How to calculate the result of

1 - 2 + 3 - 4 + 5 - 6 + 7 - 8 + 9 - 10?

Target values in each iteration:

- Iteration 1: +1
- Iteration 2: -2
- Iteration 3: +3
- Iteration 4: -4
- ⋮
- Iteration 9: +9
- Iteration 10: -10

generalize

Iteration i

- **i is odd: +i**
- **i is even: -i**

Problem 6: Python Code

How to calculate the result of

1 - 2 + 3 - 4 + 5 - 6 + 7 - 8 + 9 - 10?

Three Important Elements

- result variable
- `for` loop
- target value

Iteration i

- **i is odd: +i**
- **i is even: -i**

```
n = 10
result = 0

for i in range(1,n+1):
    if i%2 == 1:
        result = result + i
    else:
        result = result - i

print(result)
```

Problem 7

How to calculate the result of

0/1 - 1/2 + 2/3 - 3/4 + 4/5 - 5/6 + 6/7 - 7/8 + 8/9 - 9/10?

Target values in each iteration:

- Iteration 1: +0/1
- Iteration 2: -1/2
- Iteration 3: +2/3
- Iteration 4: -3/4
  - •
  - •
  - •
- Iteration 9: +8/9
- Iteration 10: -9/10

generalize

Iteration i

- **i is odd: +(i-1)/i**
- **i is even: -(i-1)/i**

Problem 7: Python Code

How to calculate the result of

0/1 - 1/2 + 2/3 - 3/4 + 4/5 - 5/6 + 6/7 - 7/8 + 8/9 - 9/10?

Three Important Elements

- result variable
- `for` loop
- target value

Iteration i

- **i is odd: +(i-1)/i**
- **i is even: -(i-1)/i**

```
n = 10
result = 0

for i in range(1,n+1):
    if i%2 == 1:
        result = result + (i-1)/i
    else:
        result = result - (i-1)/i

print(result)
```

Summary

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In this lesson, we have learned:

- Iterative Accumulation
- Application of Pattern Recognition in Python

References for Images

No.	Slide No.	Image	Reference
1	6		Question problem [Online Image]. Retrieved April 18, 2018 from https://pixabay.com/en/question-problem-think-thinking-622164/.