Chapter 5-1

Algorithmic Thinking

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One-Way Selection

- One-Way Selection: **if** Statement

Syntactic representation	Python syntax

if CONDITION then
  ACTIONS
endif
	if CONDITION:
	  statements
	Important: Indentation!!

Example of **if** statement

```
if orderAmount < 40:
    shippingCost = 10
```

```
if grade >= 90:
    print('Grade: A')
print('Score:', grade)
```


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One-Way Selection

Exercise!

- ✓ A의 값이 차례로 5, 10, 15, 20일 때 아래 명령의 실행 결과는?

```
if (not A <= 10) and (not A > 20):
    print('A =',A)
```

- ✓ letter의 값이 차례로 'i', 'E', 'c', 'ae'일 때 아래 명령의 실행 결과는?

```
if (letter in 'AEIOU') or (letter in 'aeiou'):
    print('Vowel')
```


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Two-way Selection

- Two-way selection: **if – else** statement

Syntactic representation	Python syntax

if CONDITION then
  IF-TRUE-ACTIONS
else
  IF-FALSE-ACTIONS
Endif
	if CONDITION:
	  statements
	else:
	  statements

Example of **if-else** statement

```
if orderAmount < 40:
    shippingCost = 10
else:
    shippingCost = 0
```


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Two-way Selection

Exercise!

✓ 아래 코드의 실행 결과는?

```
n = int(input('Enter an integer: '))

if n % 2 == 0:
    print(n,'is an even integer')
else:
    print(n, 'is an odd integer')
```


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Multi-way Selection

- Multi-way selection: **if – elif – else** statement

Syntactic representation	Python syntax

if $CONDITION_1$ then
  $IF\text{-}CONDITION_1\text{-}TRUE\text{-}ACTIONS$
elseif $CONDITION_2$ then
  $IF\text{-}CONDITION_2\text{-}TRUE\text{-}ACTIONS$
  …
elseif $CONDITION_n$ then
  $IF\text{-}CONDITION_n\text{-}TRUE\text{-}ACTIONS$
else
  $IF\text{-}CONDITION_{1..n}\text{-}FALSE\text{-}ACTIONS$
Endif
	if $CONDITION_1$:
	  statements
	elif $CONDITION_2$:
	  statements
	  …
	elif $CONDITION_n$:
	  statements
	else:
	  statements

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Multi-way Selection

Multi-Way Selection by nested if-else statements

```
if grade >= 90:
    print('Grade: A')
else:
    if grade >= 80:
        print('Grade: B')
    else:
        if grade >= 70:
            print('Grade: C')
        else:
            if grade >= 60:
                print('Grade: D')
            else:
                print('Grade: F')
```


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Multi-way Selection

Multi-Way Selection by if-elif-else statements

```
if grade >= 90:
    print('Grade: A')
elif grade >= 80:
    print('Grade: B')
elif grade >= 70:
    print('Grade: C')
elif grade >= 60:
    print('Grade: D')
else:
    print('Grade: F')
```


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Multi-way Selection

Exercise!

- ✓ 나이를 입력 받아 2세 이하는 Infant, 3~12세는 Child, 13~19세는 Teenager, 20세 이상은 Adult를 출력하는 코드를 작성하세요

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Repetition

- Repetition: **while** loop

Syntactic representation	Python syntax

while CONDITION do
ACTIONS
endwhile
	while CONDITION:
	statements
	Important: Indentation!!

Example of while statement

```
steakTemp = 75
minOnGrill = 0
while steakTemp < 135:
    steakTemp = steakTemp + 13
    minOnGrill = minOnGrill + 3
```


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Repetition

- Repetition: **while** loop

```
steakTemp = 75
minOnGrill = 0
while ①steakTemp < 135:
    ②steakTemp = steakTemp + 13
    ③minOnGrill = minOnGrill + 3
```

Iteration	① steakTemp < 135	②steakTemp	③minOnGrill
before		75	0
1	75 < 135 ➔ True	88	3
2	88 < 135 ➔ True	101	6
3	101 < 135 ➔ True	114	9
4	114 < 135 ➔ True	127	12
5	127 < 135 ➔ True	140	15
6	140 < 135 ➔ False	140	15

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Repetition

Exercise!

- ✓ 1부터 100까지 정수의 합을 구하여 출력하는 알고리즘을 작성하세요

```
i = 0
total = 0

while i <= 100:
    total = total + i
    i = i + 1

print('sum from 1 to 100:', total)
```


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반복문의 활용

- 반복 회수를 특정하지 않고 정해진 조건을 만족할 때 까지 반복을 실행
  1) 사용자로 부터 올바른 입력을 받기를 원할 때

예1) 올바른 음계 입력을 받기 위한 반복문

```
note = input('Enter a note: ')
while note not in 'ABCDEFG':
    print('Wrong input')
    note = input('Enter a note:')
```

예2) 올바른 범위의 나이를 받기 위한 반복문

```
age = int(input('Enter an age: '))

while age < 0 or age > 125:
    print('Wrong Input')
    age = int(input('Enter an age: '))
```


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Repetition

반복문의 활용

- 반복 회수를 특정하지 않고 정해진 조건을 만족할 때 까지 반복을 실행

  2) 정해진 상태동안 프로그램의 실행을 계속 하기를 원할 때

```
end_of_composition = False
music = ''

while not end_of_composition:
    note = input('Enter a note(Q:quit): ')
    while note not in 'ABCDEFGQ':
        print('Wrong input')
        note = input('Enter a note(Q:quit):')
    if note != 'Q':
        music = music + note
    else:
        end_of_composition = True

print('Your music:', music)
```

프로그램의 실행을 지속 하기 위한 상태: False

작곡이 끝나지 않았으면 반복문 내용을 수행

Q가 입력되면 작곡을 끝냄

프로그램의 실행을 종료하기 위한 상태: True

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Computational Problem

The Problem

Simple ATM Program

아래와 같은 기능을 가지는 간단한 ATM 프로그램을 작성하세요. 단 출금 시 잔고가 부족할 경우에는 에러 메세지를 출력합니다

1) (D)eposit
2) (W)ithdraw
3) Display (B)alance
4) (T)erminate

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Simple ATM Program

Problem Analysis

입금, 출금 및 잔고 출력 선택에 따른 분기 필요

잔고보다 출금 금액이 큰 경우에 대한 체크 필요

종료 명령 전까지 입력을 계속 입력 받기 위한 반복문 필요

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Simple ATM Program

Data Representation

잔고

balance

금액

amount

메뉴 선택

choice

반복을 제어하기 위한 변수

terminated

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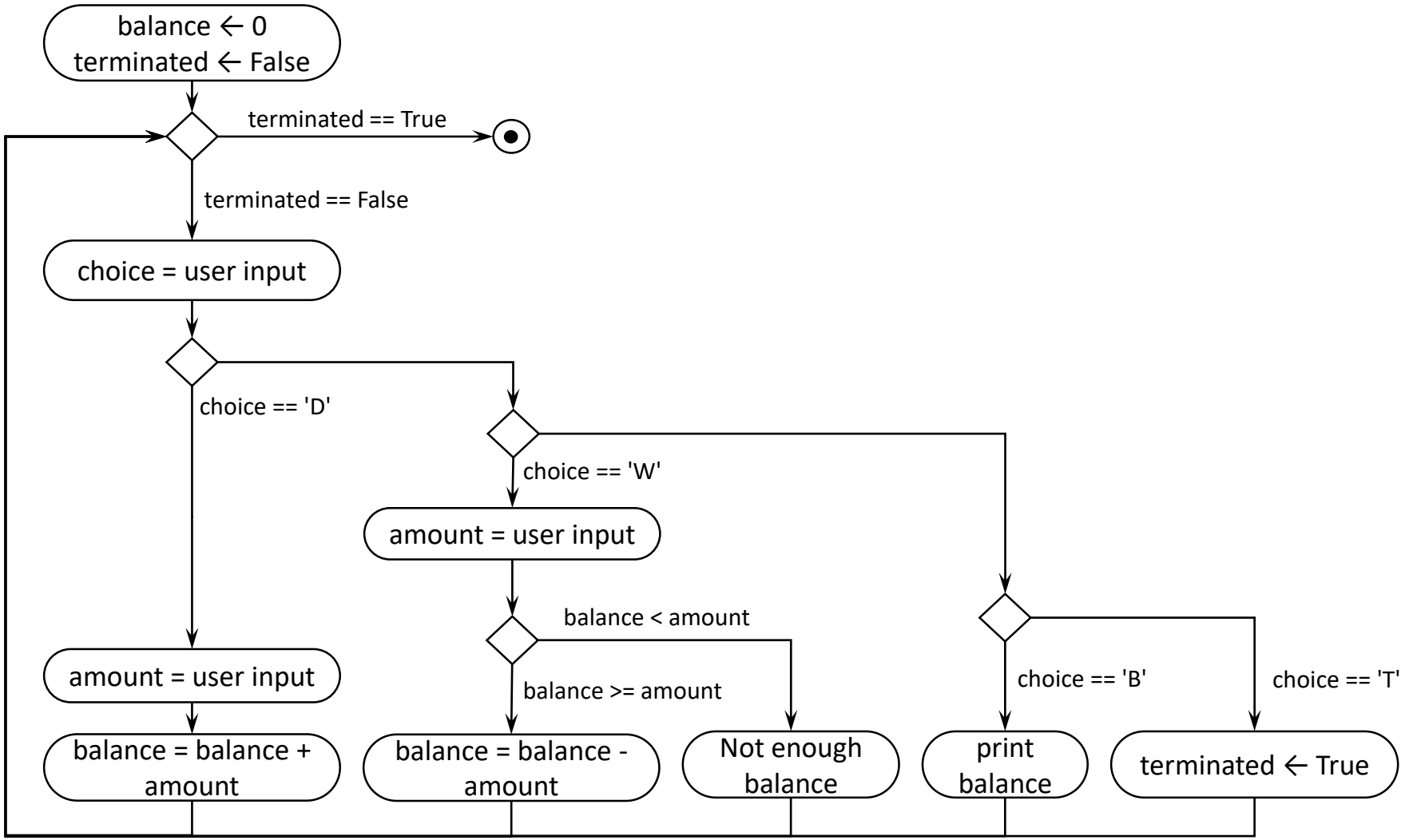
Simple ATM Program

Algorithmic Thinking



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Simple ATM Program

Program Design

Program Requirements

입금, 출금, 잔고 출력 기능

잔고 부족 시 경고문 출력

반복 입력

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Simple ATM Program

Program Design

Introduction

ATM 서비스 환영 메시지 출력

Input

메뉴 선택 및 금액 입력

Process

입금, 출금 및 잔액 계산

Output

결과 출력

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Simple ATM Program

Program Implementation

```
balance = 0
terminated = False
print('Welcome to ATM Service')

while not terminated:
    choice = input('(D)eposit, (W)ithdrawal, (B)alace, (T)erminate: ')
    if choice == 'D':
        amount = int(input('Enter amount: '))
        balance = balance + amount
    elif choice == 'W':
        amount = int(input('Enter amount: '))
        if amount <= balance:
            balance = balance - amount
        else:
            print('Not enough balance')
    elif choice == 'B':
        print('Current balance is', balance)
    elif choice == 'T':
        terminated = True
```


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Simple ATM Program

Program Execution

```
Welcome to ATM Service
(D)eposit, (W)ithdrawal, (B)alance, (T)erminate: W
Enter amount: 10
Not enough balance
(D)eposit, (W)ithdrawal, (B)alance, (T)erminate: D
Enter amount: 100
(D)eposit, (W)ithdrawal, (B)alance, (T)erminate: W
Enter amount: 80
(D)eposit, (W)ithdrawal, (B)alance, (T)erminate: B
Current balance is 20
(D)eposit, (W)ithdrawal, (B)alance, (T)erminate: T
>>>
```


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