Web/Python Programming

웹/파이썬 프로그래밍

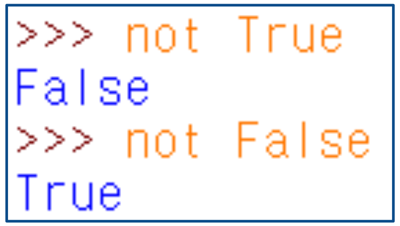
Today

- Review the type `bool`
- Boolean operators: and, or, not
- Relational operators: >, <, >=, <=, ==, !=
- Comparing strings (ASCII)
- `if` statement

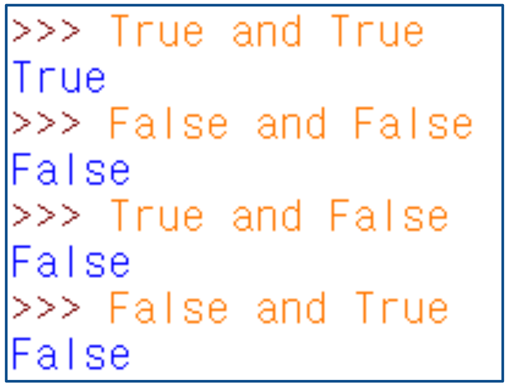
Making choices

- A Boolean type, `bool` can have the value either `true` or `false.`

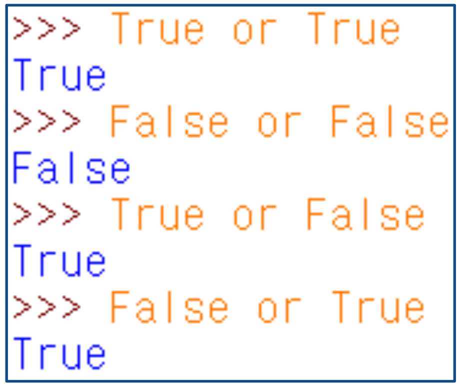
- Boolean operators : `and, or, not`
  - `not` is a unary operator: the operator is applied to just one value
  - `and, or` are binary operators: the operator is applied to two values.



```
>>> not True
False
>>> not False
True
```



```
>>> True and True
True
>>> False and False
False
>>> True and False
False
>>> False and True
False
```



```
>>> True or True
True
>>> False or False
False
>>> True or False
True
>>> False or True
True
```

Truth table

- When a and b are Boolean type variables,

a	b
True	True
False	False
True	False
False	True

- Inclusive or (OR) vs. Exclusive or (XOR)
  - Inclusive or: a or b (False if and only if both are False)
  - Exclusive or: Do you want to meet on Monday or Tuesday?
  - a XOR b is represented as `(a and not b) or (not a and b)`

Relational operators

```
>>> 45 > 34
True
>>> 45 > 79
False
>>> 45 < 79
True
>>> 45 < 34
False
>>> 23.1 >= 23
True
>>> 23.1 >= 23.1
True
>>> 23.1 <= 23.1
True
>>> 23.1 <= 23
False
```

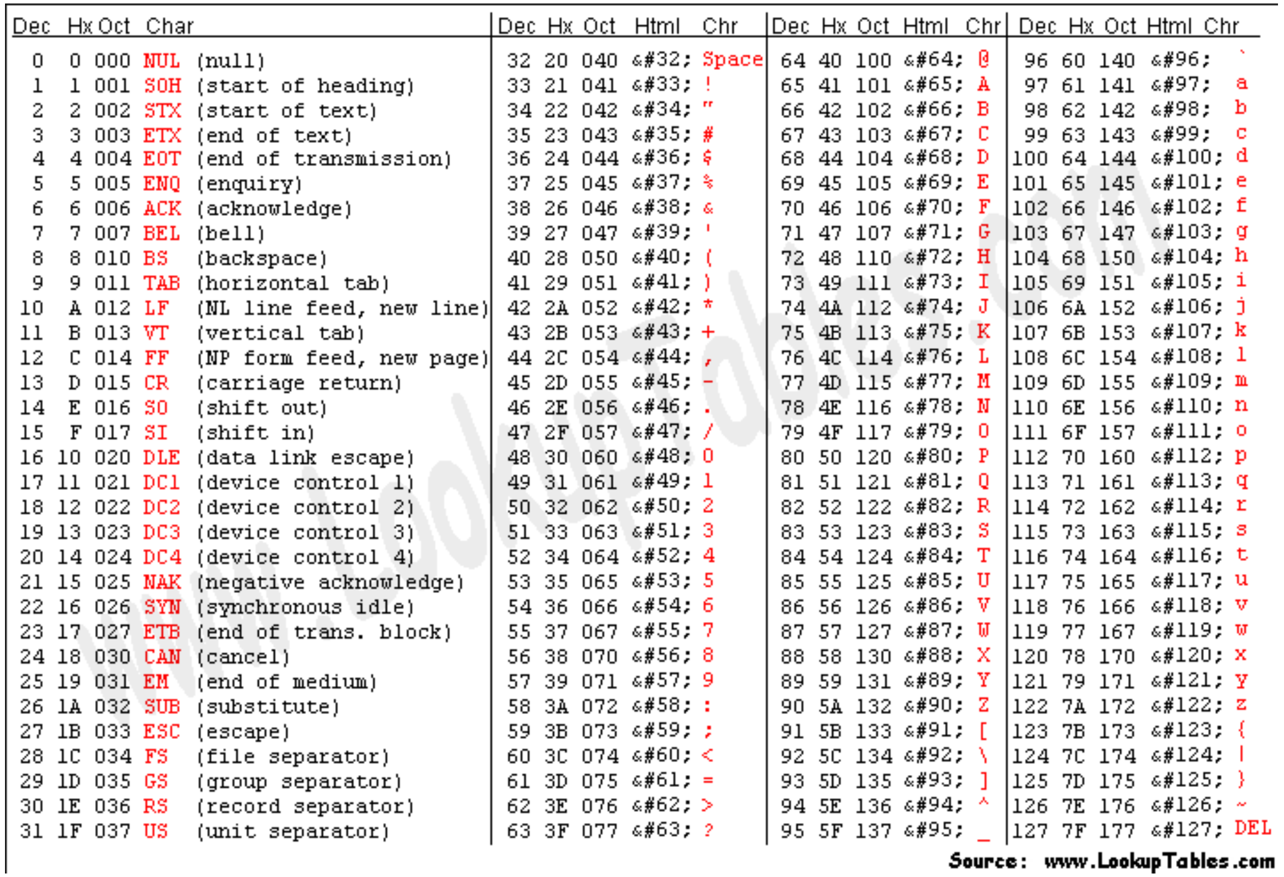
```
>>> 67.3 == 87
False
>>> 67.3 == 67
False
>>> 67.0 == 67
True
>>> 67.0 != 67
False
>>> 67.0 != 23
True
```

Symbol	Operation
>	Greater than
<	Less than
>=	Greater than or equal to
<=	Less than or equal to
==	Equal to
!=	Not equal to

Table 6—Relational and Equality Operators

Comparing Strings

- ASCII: American Standard Code for Information Interchange



Dec	Hx	Oct	Char	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr
0	0	000	NUL (null)	32	20	040	&#32;	Space	64	40	100	&#64;	@	96	60	140	&#96;	`
1	1	001	SOH (start of heading)	33	21	041	&#33;	!	65	41	101	&#65;	A	97	61	141	&#97;	a
2	2	002	STX (start of text)	34	22	042	&#34;	"	66	42	102	&#66;	B	98	62	142	&#98;	b
3	3	003	ETX (end of text)	35	23	043	&#35;	#	67	43	103	&#67;	C	99	63	143	&#99;	c
4	4	004	EOT (end of transmission)	36	24	044	&#36;	$	68	44	104	&#68;	D	100	64	144	&#100;	d
5	5	005	ENQ (enquiry)	37	25	045	&#37;	%	69	45	105	&#69;	E	101	65	145	&#101;	e
6	6	006	ACK (acknowledge)	38	26	046	&#38;	&	70	46	106	&#70;	F	102	66	146	&#102;	f
7	7	007	BEL (bell)	39	27	047	&#39;	'	71	47	107	&#71;	G	103	67	147	&#103;	g
8	8	010	BS (backspace)	40	28	050	&#40;	(	72	48	110	&#72;	H	104	68	150	&#104;	h
9	9	011	TAB (horizontal tab)	41	29	051	&#41;	)	73	49	111	&#73;	I	105	69	151	&#105;	i
10	A	012	LF (NL line feed, new line)	42	2A	052	&#42;	*	74	4A	112	&#74;	J	106	6A	152	&#106;	j
11	B	013	VT (vertical tab)	43	2B	053	&#43;	+	75	4B	113	&#75;	K	107	6B	153	&#107;	k
12	C	014	FF (NP form feed, new page)	44	2C	054	&#44;	,	76	4C	114	&#76;	L	108	6C	154	&#108;	l
13	D	015	CR (carriage return)	45	2D	055	&#45;	-	77	4D	115	&#77;	M	109	6D	155	&#109;	m
14	E	016	SO (shift out)	46	2E	056	&#46;	.	78	4E	116	&#78;	N	110	6E	156	&#110;	n
15	F	017	SI (shift in)	47	2F	057	&#47;	/	79	4F	117	&#79;	O	111	6F	157	&#111;	o
16	10	020	DLE (data link escape)	48	30	060	&#48;	0	80	50	120	&#80;	P	112	70	160	&#112;	p
17	11	021	DC1 (device control 1)	49	31	061	&#49;	1	81	51	121	&#81;	Q	113	71	161	&#113;	q
18	12	022	DC2 (device control 2)	50	32	062	&#50;	2	82	52	122	&#82;	R	114	72	162	&#114;	r
19	13	023	DC3 (device control 3)	51	33	063	&#51;	3	83	53	123	&#83;	S	115	73	163	&#115;	s
20	14	024	DC4 (device control 4)	52	34	064	&#52;	4	84	54	124	&#84;	T	116	74	164	&#116;	t
21	15	025	NAK (negative acknowledge)	53	35	065	&#53;	5	85	55	125	&#85;	U	117	75	165	&#117;	u
22	16	026	SYN (synchronous idle)	54	36	066	&#54;	6	86	56	126	&#86;	V	118	76	166	&#118;	v
23	17	027	ETB (end of trans. block)	55	37	067	&#55;	7	87	57	127	&#87;	W	119	77	167	&#119;	w
24	18	030	CAN (cancel)	56	38	070	&#56;	8	88	58	130	&#88;	X	120	78	170	&#120;	x
25	19	031	EM (end of medium)	57	39	071	&#57;	9	89	59	131	&#89;	Y	121	79	171	&#121;	y
26	1A	032	SUB (substitute)	58	3A	072	&#58;	:	90	5A	132	&#90;	Z	122	7A	172	&#122;	z
27	1B	033	ESC (escape)	59	3B	073	&#59;	;	91	5B	133	&#91;	[	123	7B	173	&#123;	{
28	1C	034	FS (file separator)	60	3C	074	&#60;	<	92	5C	134	&#92;	\	124	7C	174	&#124;	|
29	1D	035	GS (group separator)	61	3D	075	&#61;	=	93	5D	135	&#93;	]	125	7D	175	&#125;	}
30	1E	036	RS (record separator)	62	3E	076	&#62;	>	94	5E	136	&#94;	^	126	7E	176	&#126;	~
31	1F	037	US (unit separator)	63	3F	077	&#63;	?	95	5F	137	&#95;	_	127	7F	177	&#127;	DEL

Source: www.LookupTables.com

Comparing Strings

- Lexicographically

```
>>> 'A' < 'a'
True
>>> 'A' > 'z'
False
>>> 'abc' < 'abd'
True
>>> 'abc' < 'abcd'
True
>>> '가' < '나'
True
>>> '가나' < '가다'
True
>>> '가나다' < '가나'
False
>>> '가' > '거'
False
```

- Checks whether one string appears inside another one:

```
>>> 'Jan' in '01 Jan 1838'
True
>>> 'Feb' in '01 Jan 1838'
False

>>> date = input('Enter a date in the format DD MTH YYYY: ')
Enter a date in the format DD MTH YYYY: 20 Mar 2017
>>> 'Jan' in date
False
>>> 'Mar' in date
True

>>> 'a' in 'abc'
True
>>> 'A' in 'abc'
False
>>> "" in 'abc'
True
```

# case sensitive!!

# empty string is always

# a substring of every string

`if` statement

```
if <<condition>>:
    <<block>>
```

Indentation required!!

- Condition
  - Usually a Boolean expression
  - Has be an expression that can be interpreted as True or False
- Block
  - If the condition is true, the statements in the block are executed.
  - Otherwise, they are not executed.

`if` statement example

- A table of solution categories based on pH level

pH level	Solution Category
0-4	Strong acid
5-6	Weak acid
7	Neutral
8-9	Weak base
10-14	Strong base

```
ph = float(input('Enter the pH level: '))

if ph < 7.0:
    print(ph, "is acidic.")
    print("Be careful with that!")
```

`if` statement example

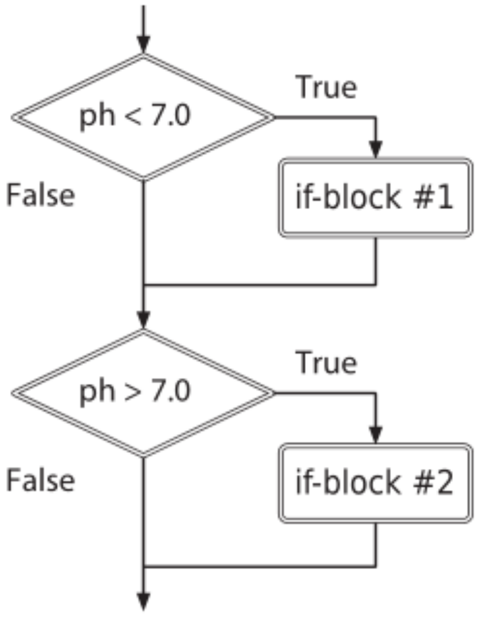
- A table of solution categories based on pH level

pH level	Solution Category
0-4	Strong acid
5-6	Weak acid
7	Neutral
8-9	Weak base
10-14	Strong base

```
ph = float(input('Enter the pH level: '))

if ph < 7.0:
    print(ph, "is acidic.")
print(“Be careful with that!”)
```

`if` statement example

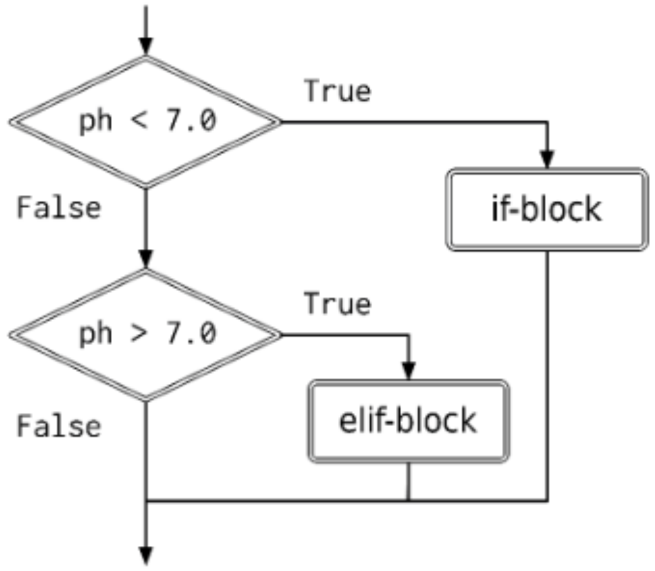
- Flow chart



```
ph = float(input('Enter the pH level: '))

if ph < 7.0:
    print(ph, "is acidic.")

if ph > 7.0:
    print(ph, “is basic.”)
```

`if` statement example

- Flow chart



```
ph = float(input('Enter the pH level: '))

if ph < 7.0:
    print(ph, "is acidic.")
elif ph > 7.0:
    print(ph, “is basic.”)
```

`elif` **is checked only when the** `if` **condition above it evaluated to** `False`

if/elif

```
ph = float(input('Enter the pH
level: '))


if ph < 7.0:
    ph = 8.0

if ph > 7.0:
    print(ph, “is acidic.”)
```

```
ph = float(input('Enter the pH
level: '))


if ph < 7.0:
    ph = 8.0
elif ph > 7.0:
    print(ph, “is acidic.”)
```

If the two conditions are related, use `if/elif` instead of two `if`s.

Multiple elif

```
compound = input('Enter the
compound: ')

if compound == "H2O":
    print("Water")
elif compound == "NH3":
    print("Ammonia")
elif compound == "CH4":
    print("Methane")
```

```
>>> Enter the compound: CH4
Methane
>>>

>>> Enter the compound: H2SO4
>>>
```

Multiple elif

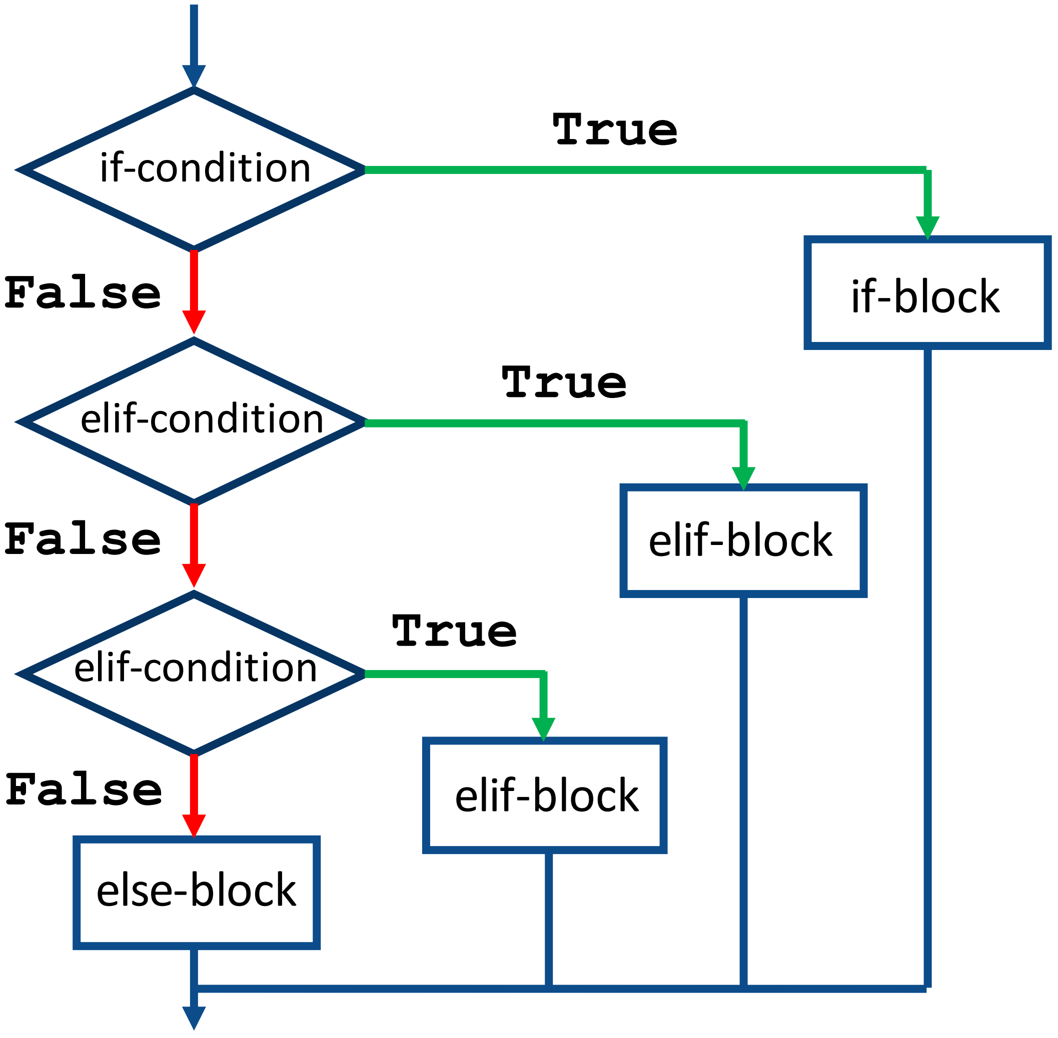
```
compound = input('Enter the
compound: ')

if compound == "H2O":
    print("Water")
elif compound == "NH3":
    print("Ammonia")
elif compound == "CH4":
    print("Methane")
else:
    print("Unknown compound")
```

```
>>> Enter the compound: CH4
Methane
>>>
```

```
>>> Enter the compound: H2SO4
Unknown compound
>>>
```

Typical if statement and flow chart

```
if <<if-condition>>:
    <<if_block>>
elif <<elif-condition>>:
    <<elif_block>>
elif <<elif-condition>>:
    <<elif_block>>
else:
    <<else_block>>
```



Nested if statements

```
ph = float(input(‘Enter the pH level: ‘))

if 0<= ph <=14:
    if ph < 7.0:
        print(ph, "is acidic.")
    elif ph > 7.0:
        print(ph, "is basic.")
    else:
        print(ph, "is neutral.")
else:
    print("pH value has to be a number between 0 and 14.")
```

Use of Boolean variable

```
if age < 45:
    if bmi < 22.0:
        risk = 'low'
    else:
        risk = 'medium'
else:
    if bmi < 22.0:
        risk = 'medium'
    else:
        risk = 'high'
```

```
young = age < 45
slim = bmi < 22.0
if young:
    if slim:
        risk = 'low'
    else:
        risk = 'medium'
else:
    if slim:
        risk = 'medium'
    else:
        risk = 'high'
```

Use of Boolean variable

```
young = age < 45
slim = bmi < 22.0
if young and slim:
    risk = 'low'
elif young and not slim:
    risk = 'medium'
elif not young and slim:
    risk = 'medium'
elif not young and not slim:
    risk = 'high'
```

```
young = age < 45
slim = bmi < 22.0
if young:
    if slim:
        risk = 'low'
    else:
        risk = 'medium'
else:
    if slim:
        risk = 'medium'
    else:
        risk = 'high'
```

Summary

- Python uses Boolean values, `True` and `False`, to represent what is true and what isn't. Programs can combine these values using three operators: `not`, `and`, and `or`.
- Boolean operators can also be applied to numeric values. `0`, `0.0`, the empty string, and `None` are treated as `False`; all other numeric values and strings are treated as `True`. It is best to avoid applying Boolean operators to non-Boolean values.
- Relational operators such as "equals" and "less than" compare values and produce a Boolean result.
- When different operators are combined in an expression, the order of precedence from highest to lowest is arithmetic, relational, and then Boolean.
- `if` statements control the flow of execution. As with function definitions, the bodies of `if` statements are indented, as are the bodies of `elif` and `else` clauses.