

Type of Data

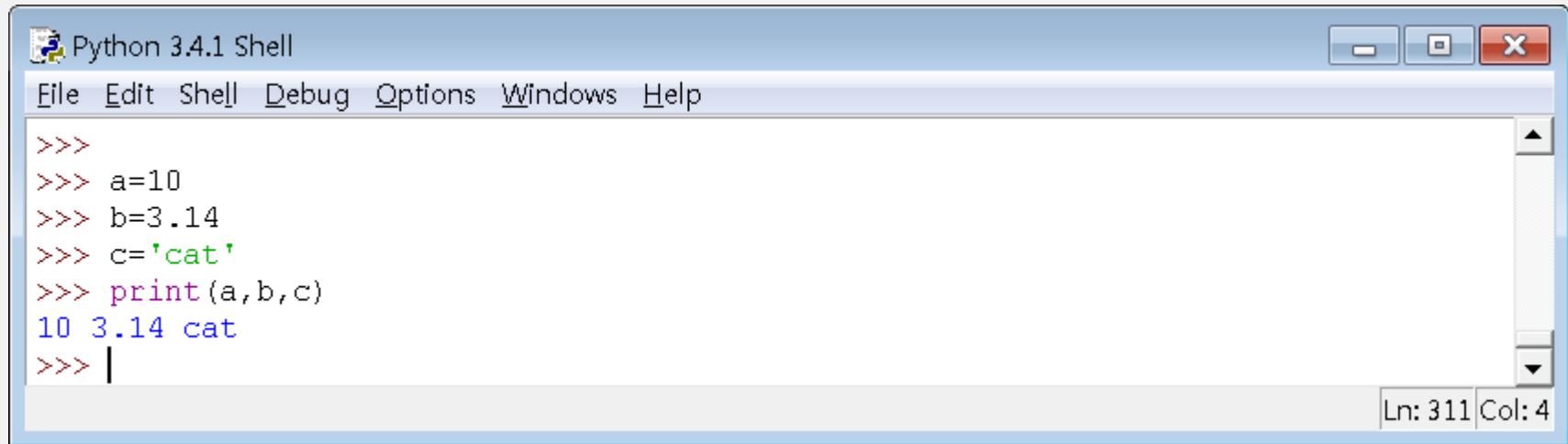
국민대 소프트웨어학부

수업목표

- Numeric, character
- String data
- Boolean data
- Changing types
- `type()`
- Type-conversion errors
- Type conversions
- 심화학습

Numeric, character

- 정수, 실수, 문자열



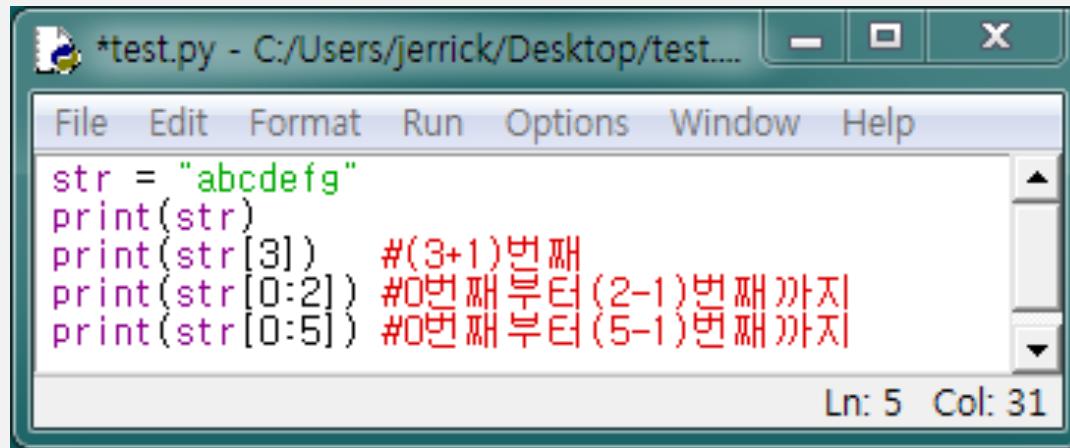
Python 3.4.1 Shell

```
>>>
>>> a=10
>>> b=3.14
>>> c='cat'
>>> print(a,b,c)
10 3.14 cat
>>> |
```

Ln: 311 Col: 4

String

- 문자열 인덱스(index)와 부분문자(substring) 출력



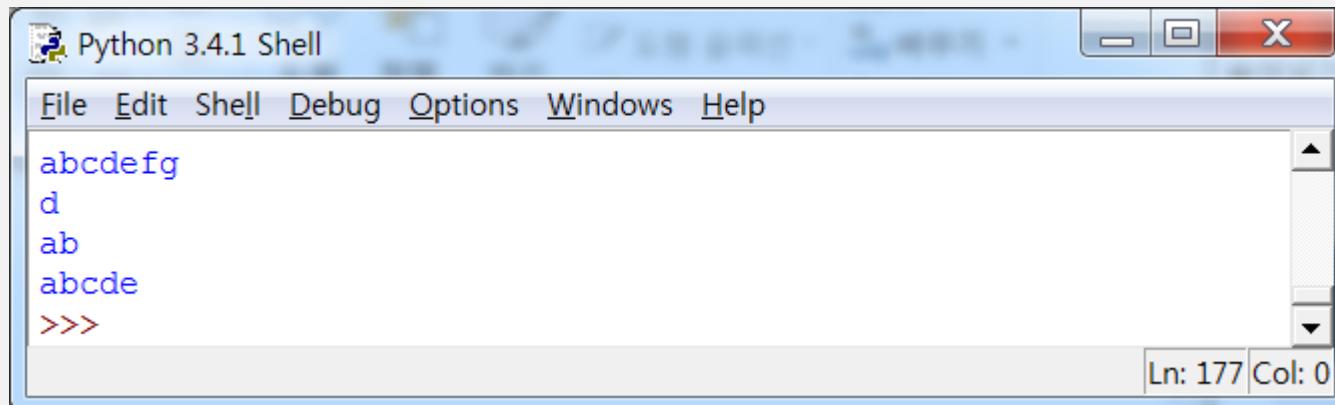
```
*test.py - C:/Users/jerrick/Desktop/test....
```

```
File Edit Format Run Options Window Help
```

```
str = "abcdefg"
print(str)
print(str[3])  #(3+1)번째
print(str[0:2]) #0번째부터(2-1)번째까지
print(str[0:5]) #0번째부터(5-1)번째까지
```

Ln: 5 Col: 31

This screenshot shows a Python code editor window with a file named 'test.py'. The code defines a string 'str' and prints it. It then prints the 4th character (index 3) and two substrings: from index 0 to 1, and from index 0 to 4. The code editor interface includes a menu bar with File, Edit, Format, Run, Options, Window, and Help, and a status bar at the bottom indicating line 5 and column 31.



```
Python 3.4.1 Shell
```

```
File Edit Shell Debug Options Windows Help
```

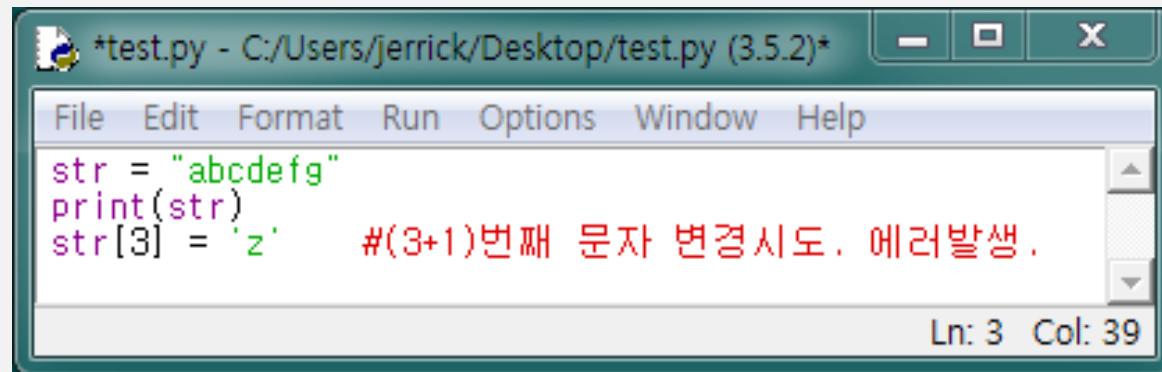
```
abcdefg
d
ab
abcde
>>>
```

Ln: 177 Col: 0

This screenshot shows a Python shell window titled 'Python 3.4.1 Shell'. It displays the output of the code from the editor. The output consists of the string 'abcdefg' followed by three individual characters 'd', 'ab', and 'abcde', and a final prompt '>>>'. The shell interface includes a menu bar with File, Edit, Shell, Debug, Options, Windows, and Help, and a status bar at the bottom indicating line 177 and column 0.

String

- 문자열은 불변(immutable) 데이터 타입
 - 변경이 불가능함. 새롭게 생성하여 할당함.

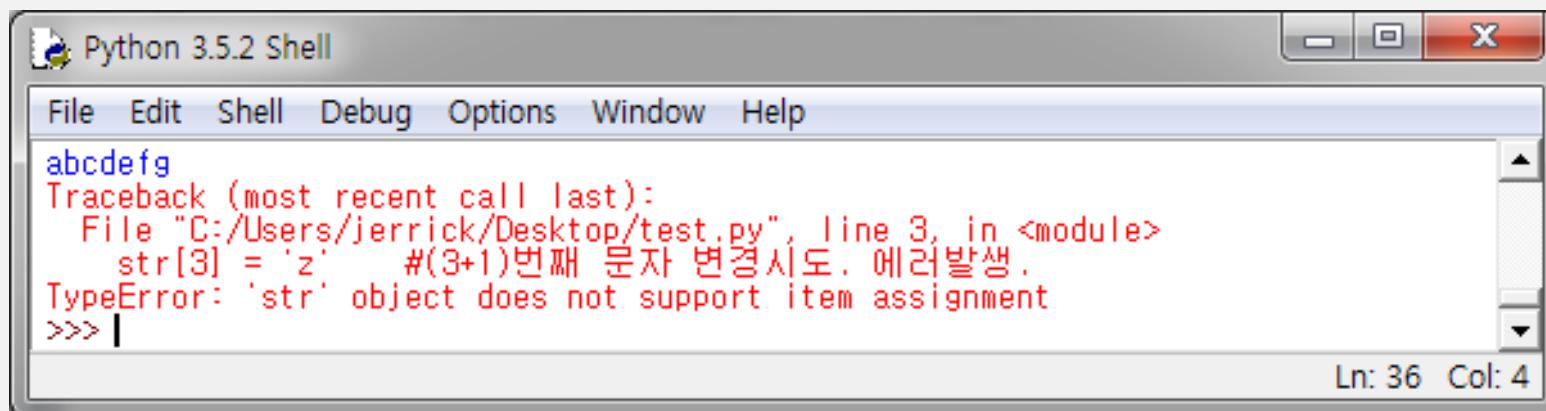


The screenshot shows a Python code editor window with the following code:

```
test.py - C:/Users/jerrick/Desktop/test.py (3.5.2)*
File Edit Format Run Options Window Help
str = "abcdefg"
print(str)
str[3] = 'z'  #(3+1)번째 문자 변경시도. 에러발생.

Ln: 3 Col: 39
```

The code defines a string 'str' and prints it. Then it attempts to change the 4th character ('d') to 'z'. A red error message is displayed in the code editor: '#(3+1)번째 문자 변경시도. 에러발생.' (Attempting to change the (3+1)th character. An error occurred.)



The screenshot shows a Python shell window with the following interaction:

```
Python 3.5.2 Shell
File Edit Shell Debug Options Window Help
abcdefg
Traceback (most recent call last):
  File "C:/Users/jerrick/Desktop/test.py", line 3, in <module>
    str[3] = 'z'  #(3+1)번째 문자 변경시도. 에러발생.
TypeError: 'str' object does not support item assignment
>>> |
Ln: 36 Col: 4
```

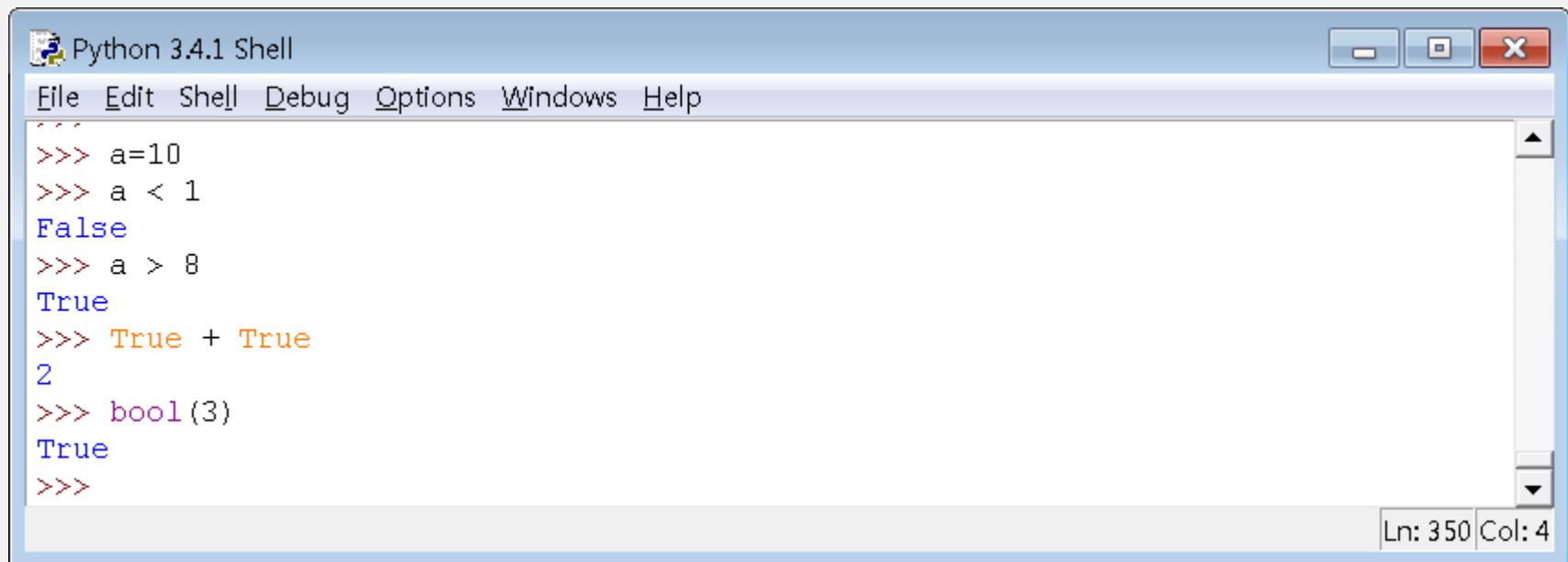
The user runs the script, and the shell shows the output of the print statement and the resulting error. The error message is identical to the one in the code editor: 'TypeError: 'str' object does not support item assignment'.

String

- 불변(immutable) 데이터 타입
 - 변경 불가능
 - Ex) 튜플(tuple), 문자열(string) 등
- 가변(mutable) 데이터 타입
 - 변경 가능
 - 리스트(list), 사전(dictionary), 집합(set) 등

Boolean Data

- Boolean
 - 참(true)과 거짓(false) 표현
 - 수학자 George Boole 발명
 - “True”는 0이 아닌 모든 실수, “False”는 0
 - bool() 함수 : Boolean 값 알려줌



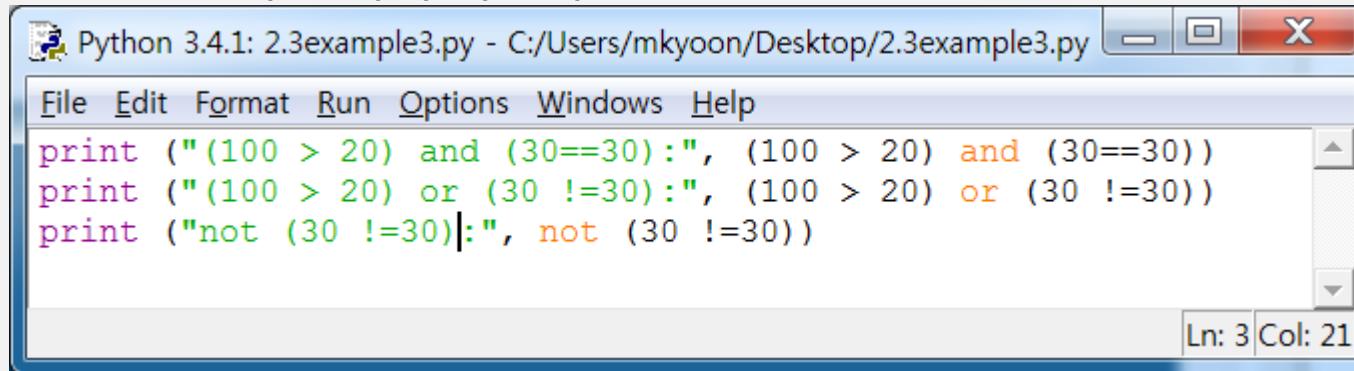
The screenshot shows a Python 3.4.1 Shell window. The menu bar includes File, Edit, Shell, Debug, Options, Windows, and Help. The command line area displays the following Python session:

```
Python 3.4.1 Shell
File Edit Shell Debug Options Windows Help
>>> a=10
>>> a < 1
False
>>> a > 8
True
>>> True + True
2
>>> bool(3)
True
>>>
```

The status bar at the bottom right shows Ln: 350 Col: 4.

Boolean Data

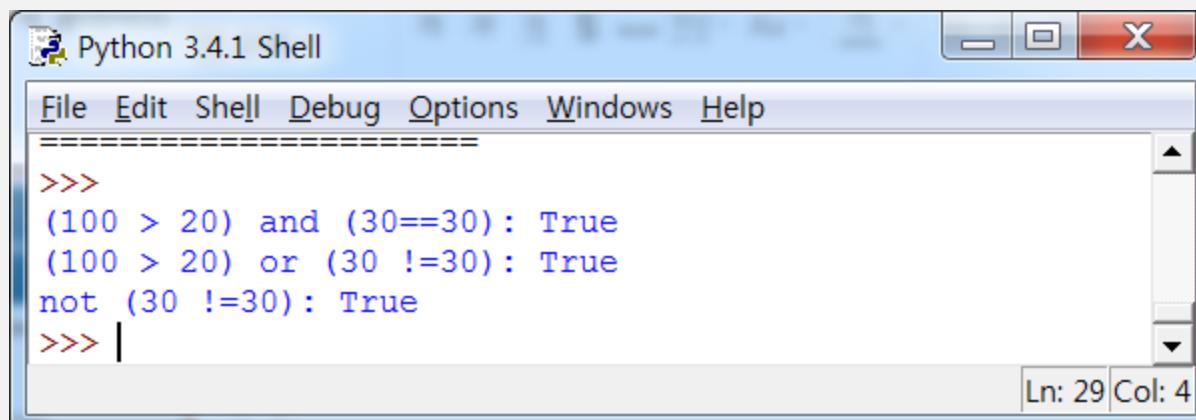
- and, or, not
 - Boolean 문장 조합 생성
 - A and B: A와 B가 동시에 True인 경우에만 True
 - A or B: A와 B 적어도 하나가 True인 경우에 True
 - not A : A의 반대에 해당하는 bool값 생성



Python 3.4.1: 2.3example3.py - C:/Users/mkyoon/Desktop/2.3example3.py

```
File Edit Format Run Options Windows Help
print ("(100 > 20) and (30==30):", (100 > 20) and (30==30))
print ("(100 > 20) or (30 !=30):", (100 > 20) or (30 !=30))
print ("not (30 !=30):", not (30 !=30))
```

Ln: 3 Col: 21



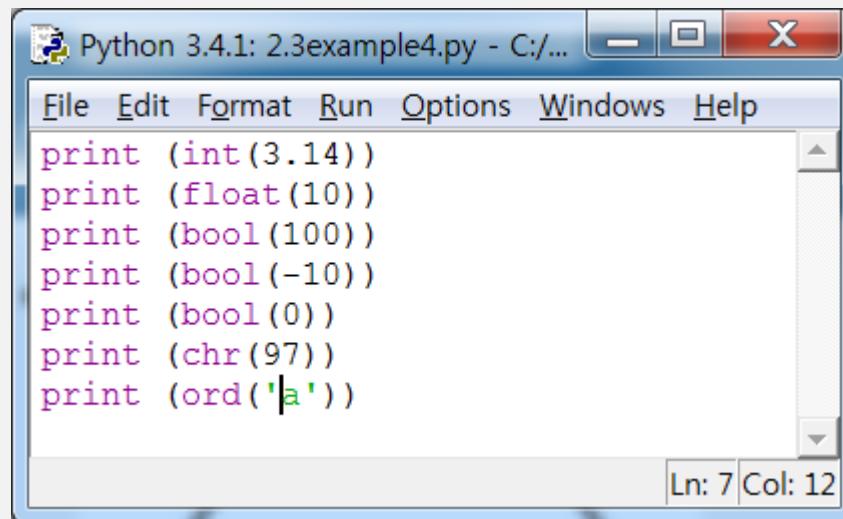
Python 3.4.1 Shell

```
File Edit Shell Debug Options Windows Help
=====
>>>
(100 > 20) and (30==30): True
(100 > 20) or (30 !=30): True
not (30 !=30): True
>>> |
```

Ln: 29 Col: 4

Changing types

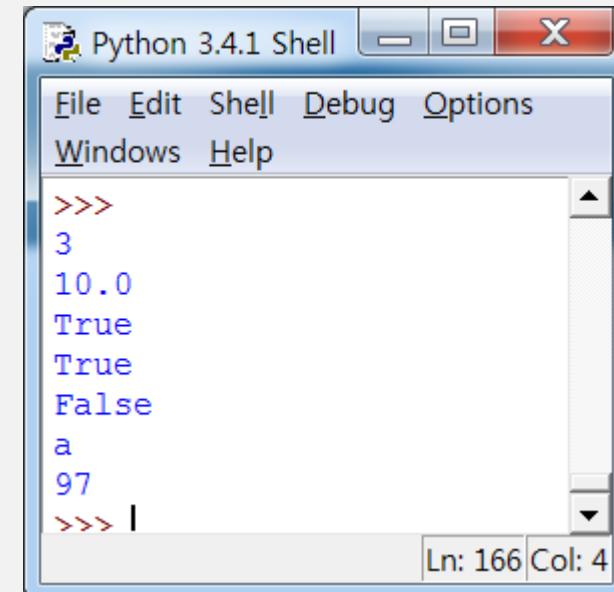
- `int()` : 정수로 변환
- `float()` : 실수로 변환
- `bool()`: Boolean으로 변환
- `chr(숫자)`: 숫자에 해당하는 아스키(ascii) 문자로 변환
- `ord(문자)`: 아스키 문자에 해당하는 숫자로 변환



Python 3.4.1: 2.3example4.py - C:/...

```
File Edit Format Run Options Windows Help
print (int(3.14))
print (float(10))
print (bool(100))
print (bool(-10))
print (bool(0))
print (chr(97))
print (ord('a'))
```

Ln: 7 Col: 12



Python 3.4.1 Shell

```
File Edit Shell Debug Options
Windows Help
>>>
3
10.0
True
True
False
a
97
>>> |
```

Ln: 166 Col: 4

Changing types

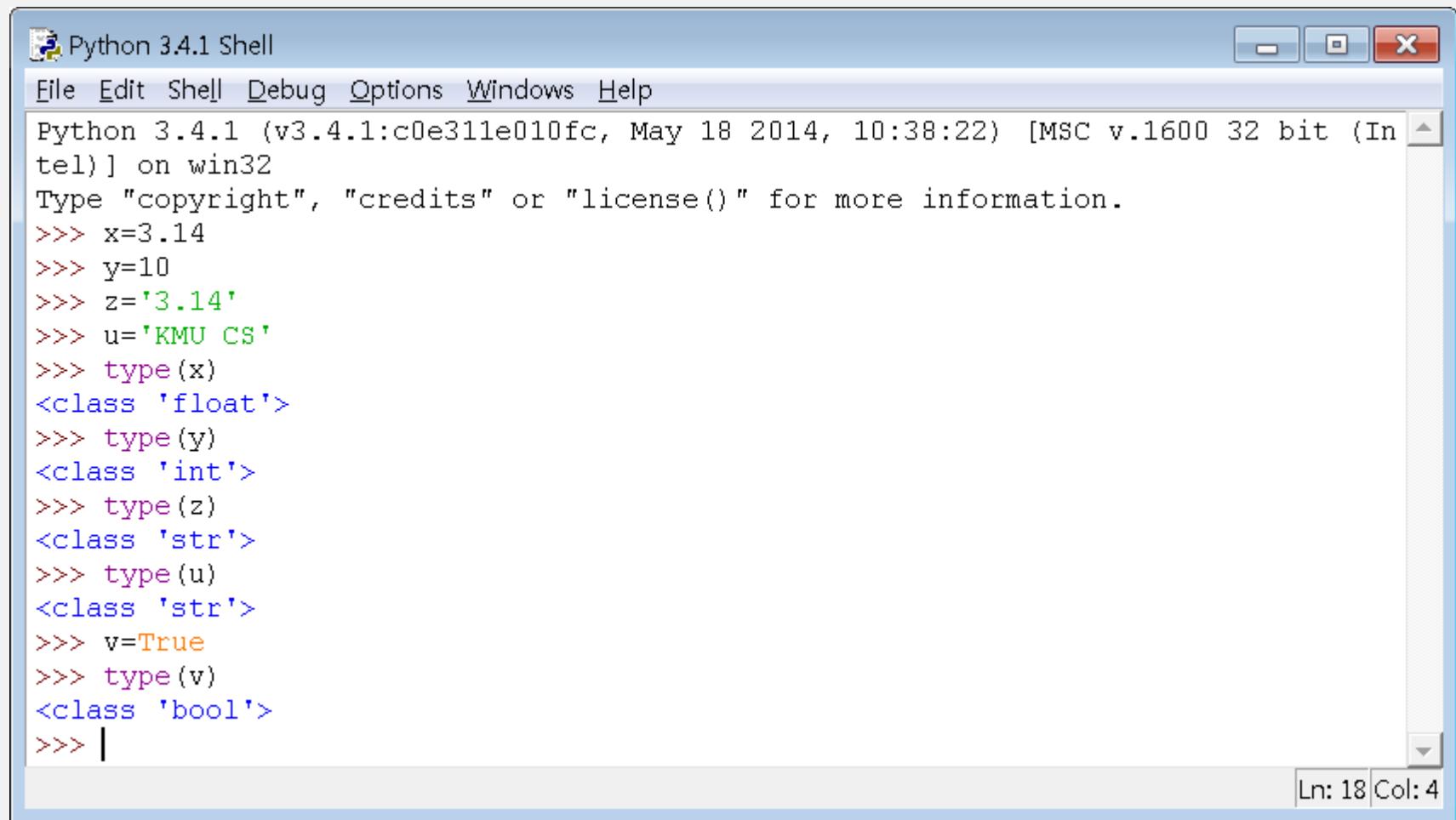
- Ascii 테이블

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

Source: www.LookupTables.com

Type()

- 변수가 가리키는 객체(object)의 타입을 알고 싶을 때 사용함



The screenshot shows the Python 3.4.1 Shell window. The title bar reads "Python 3.4.1 Shell". The menu bar includes "File", "Edit", "Shell", "Debug", "Options", "Windows", and "Help". The main window displays the following Python session:

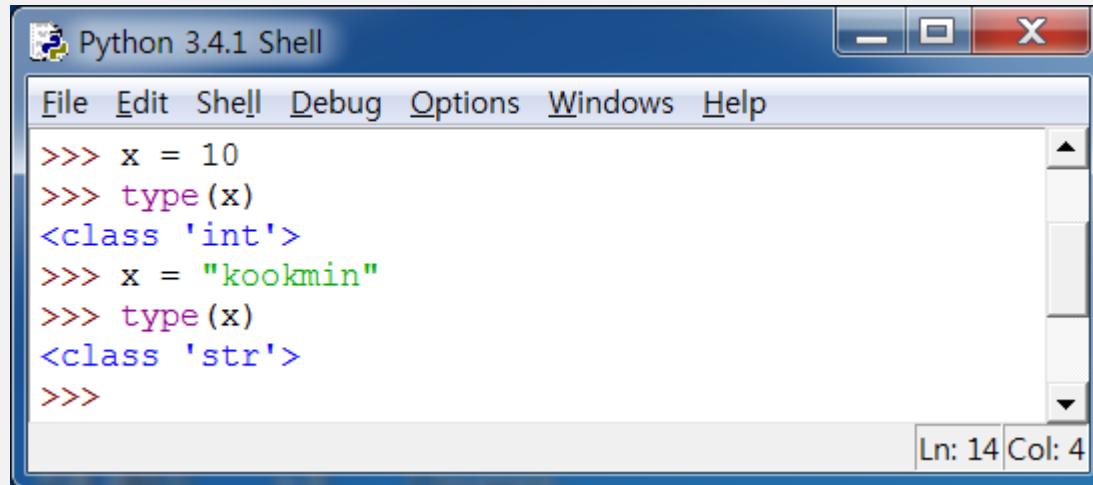
```
Python 3.4.1 (v3.4.1:c0e311e010fc, May 18 2014, 10:38:22) [MSC v.1600 32 bit (Intel)] on win32
Type "copyright", "credits" or "license()" for more information.

>>> x=3.14
>>> y=10
>>> z='3.14'
>>> u='KMU CS'
>>> type(x)
<class 'float'>
>>> type(y)
<class 'int'>
>>> type(z)
<class 'str'>
>>> type(u)
<class 'str'>
>>> v=True
>>> type(v)
<class 'bool'>
>>> |
```

The session shows the application of the `type()` function to various variables: `x` is a float, `y` is an int, `z` and `u` are strings, and `v` is a boolean. The status bar at the bottom right indicates "Ln: 18 Col: 4".

Type()

- 타입은 변수가 결정하는 것이 아니라 변수가 가리키는 객체가 결정함



The screenshot shows a Python 3.4.1 Shell window. The menu bar includes File, Edit, Shell, Debug, Options, Windows, and Help. The main window displays the following Python session:

```
>>> x = 10
>>> type(x)
<class 'int'>
>>> x = "kookmin"
>>> type(x)
<class 'str'>
>>>
```

The status bar at the bottom right shows Ln: 14 Col: 4.

Type conversions

- Python 2.x 버전 주의 사항
 - 정수와 정수를 '/' 연산자로 나누면 정수 몫 계산
 - 실수 몫이 필요한 경우에는 나누어지는 수를 float()로 강제로 형변환시켰어야했음
 - $x=7/3$ vs $x=float(7)/3$ 또는 $x=7.0/3$
 - Python 3.x 버전에서는 '/'와 '//' 연산자 구분