BIG DADDY'S PYTHON TOOLBOX For 3.5

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Reference: the print() syntax:
print(objects, sep=' ', end='\n')

Formatting Options

INTERPOLATION: "Old Style" formatting operator % - **to be deprecated,** most widely used, **has bugs**

Note: [in brackets] means optional, ↳ means yields or returns

There are **2** syntax formats:

1. string with **format/**insert (%) spec(s) % (insert values)

```
print ("The cost of %d widgets is $% .2f each %s." %(5, 202.95,"Ed"))
↳ The cost of 5 widgets is $ 202.95 each Ed.
```

2. "**format** string" % value to format

```
sft="%11.4f" \ print((sft)%(-7.5129870) ↳ -7.5130
```

sft is a string variable to hold the format spec statement ->
min field width (11), precision(.) 4 digits(4), floating point (f)

Start of format specifier

: alternate form, **0** : zero padded, **-** : left adjusted, **' '**(space) : space before pos numbers, **+** : sign +/- irequired

Precision starts with a decimal point followed by an integer specifying places

~~[len mod]~~ was planned but not implemented

% [(dict key)] [conversion flags] [minimum field width [*]] [precision: .## or [*]] conversion type

Mapping key in parens for a dictionary value

Example of format string:
%-14.4f ↳ left adj, min 14 char, 4 decimal places, floating point or **%("key1")s** use dict value for a string

integer specifying the minimum field width

https://docs.python.org/2/library/stdtypes.html#string-formatting

i/d : signed integer decimal	E : flt pt exp upper case
o : signed octal	f : floating point dec format
x : signed hex lower case	r : string using repr()
X : signed hex upper case	s : string using str()
e : flt pt exp lower case	

Recommended over interpolation: **format FUNCTION** and **format METHOD** **both** use the same format **mini-language** (available in Python **3.5**) to construct the format string. Can be VERY confusing to a new student

string format method: numerical: **"{**:format str[*1]**}".format**(value) [*1]written in mini-language, see below

string format method: substitution: "string with {replacement fields[*2]}"**.format**(replacement source) - see pg 2

[*2]replacement field: **{**[field name] [! r/s/a] [":" format_spec]**}** *ex: '{0[2]!r:>5}' = 3rd tuple val, call repr(), rt align 5 spc*

format function(value, [format_spec]**):** easiest to use but does not support any substitution fields - only string and number **format and conversion.** **format(** 12345.67890,**'0=+20,.3f')** [*1]written in mini-language, see below

What the format symbols above mean: **"{:** use format string (**string format**); **0** fill number with this character; **=** pad after sign but before number; **+** use a sign; **20** required width in characters; **,** use commas to show thousands; **.3** set (3 in this case) digit precision; **f** number type, ; **}"** - close

How the **mini-language** statements are ordered and structured in general: ***(Note:** symbols **must** be **in the order** as shown below!)*

IF align used; can be any character

With sign: **" "**(space) force leading space on + and - sign; **+** sign all; **-** neg only

forces 0 between sign & number when no align specified; like '0='

thousands separator (,) 000 - can't use with 'n'

width in chars

decimal places

[[fill] align] [sign] [# -alt form] [0 force padding default] [width] [_ ,] [.precision] [types]

<, >, ^(centered), or = '=' forces padding after a sign

Floats/Decimal - always have dec point; integers -> hex, oct, binary - add 0x/0o/0b; **'g'/'G' - retain zeros**

format(val, spec): examples

Integer types:
b - binary
c - Unicode char
d - base 10 integer
o - Octal
x - Hex - lower cs
X - Hex - upper cs
n - like d but uses local separator definitions

Float/decimal types:
e - scientific, e - exponent
E - E for exponent
f - fixed point (default 6)
F - fixed, NAN and INF
g - general format, rounds and formats
n - like g but uses local separator definitions
% - percentage, * 100, adds "%";
None - g except 1 num > .
String: s - string format, can be ommited

Numeric output examples: using 12345.6789, **-**12345.6721, 1234, 10000000

Format spec string	Yields *Note "|" symbol is col border*	Description
".3f"	|12345.679|-12345.672|1234.000|10000000.000|	fixed, 3 places, float
",.2f"	|12,345.68|-12,345.67|1,234.00|10,000,000.00|	comma sep, fixed, 2 places, float
"13,.2f"	| 12,345.68| -12,345.67| 1,234.00|10,000,000.00|	width=15, comma sep, fixed, 3 places, float
"^13,.0f"	| 12,346 | -12,346 | 1,234 | 10,000,000 |	center, width=15, comma, fixed, 3 places, float
^13,e"	|1.234568e+04 |-1.234567e+04|1.234000e+03 |1.000000e+07 |	center, set width (15), scientific
"~^13,.0f"	|~~~12,346~~~~|~~~-12,346~~~|~~~~1,234~~~~|~10,000,000~~|	fill ~, ctr, width=15, commas, 0 dec places, float
"+,.0f"	|+12,346|-12,346|+1,234|+10,000,000|	sign, comma sep, fixed, no dec places, float
"_=+13,.0f"	|+_____12,346|-_____12,346|+_____1,234|+__10,000,000|	pad _ after sign, sign, comma, no dec plcs, float
",.1%"	|1,234,567.9%|1,234,567.2%|123,400.0%|1,000,000,000.0%|	comma sep, 1 place, *100 & add %
	using 17 and 256 and 65534 and 65536	
"x^10d"	|xxxx17xxxx|xxx-256xxx|xx65534xxx|xx65536xxx|	fill w/ x, center, width=10, integer (base 10)
">#12X"	| 0X11| -0X100| 0XFFFE| 0X10000|	right align, width=12, hex (uppercase)
"b"	|10001|-100000000|1111111111111110|10000000000000000|	Binary conversion

string format: Ordering or Substituting text and numbers in statements

This syntax is in 3 PARTS: **Part 1** is **either** a way to identify which value is referenced by the literal or data container between the parens of .format(), for example '{0}' to select a data value, **or** a format spec designated by following the opening '**{**' with '**:**' ; for example '**{:**0=+20,.3f}'. **Part2** is the command - **.format()**

Part 3 is the literal strings or data containers referenced inside the .format parens. Look at it like this :

print (string with {selection values}[{x}{x}...].format(-*/**- source for seletion/insertion))

↳ a string with embeded values in {} brackets holding a selection index **or** a format specification {: in mini-language

.format'

literal values; a **tuple** to unpack preceeded by a single *; **multiple** tuple items coded in the print string: [tup#[item#]]; a **dictionary** to reference for keys coded in print string, preceeded by **

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Formatting Options

Examples using the order and replacement functions of str.format(): string & subs.format(subs source)

Objects in the following examples

```
OrderString = '{1}, {0}, {2}'
StoogeTuple = ('Larry', 'Moe', 'Curley')
ShirtTuple = ('red', 'white', 'blue', 'purple')
StoogeDict = {'Straight':'Larry',
'Dunce':'Moe', 'Foil':'Curley', 'Boob':'Don'}
PetDict = {1 : "cow", 2 : "dog", 3 : "fish"}
```

```
class Flowers(object):
    def __init__(self,
center, petals):
        self.center=center
        self.petals=petals
Daisy = Flowers
("black","yellow")
```

```
#  Simple selection and ordering of values with literals
mystring = "The tourney ranking: {1}, {3}, {0}".format /
('Larry','Moe','Curley','Donald')
print(mystring)  ↳ The tourney ranking is: Moe, Donald, Larry
#  String holding substitution/replacement selections
print('The tourney rank is: ' + OrderString.format('Abe','Bob','Cal', 'Don'))
↳   The tourney rank is: Bob, Abe, Cal
#  Named items
print("Winners: {FirstPlace}, {SecondPlace}".format (FirstPlace =
"Bob", SecondPlace ="Don"))  ↳ Winners: Bob, Don
#  Use * to unpack a single tuple (but not a list)
print("The stooges are: {2}, {1}, and {0}.".format /
(*StoogeTuple))   # note * & sub syntax
↳   The stooges are: Curley, Moe, and Larry.
#  Use the {0[value index]} without having to use *
print("My favorite stooge is {0[0]}.".format(StoogeTuple))
↳   My favorite stooge is Larry.
```

```
#  The '[0[]] structure enables us to select from multiple tuples
print("I saw {0[1]} in a {1[2]} shirt.".format(StoogeTuple, /
ShirtTuple))  ↳ I saw Moe in a blue shirt.
#  Use ** to access dictionary values by their keys
print("The stooges are: {Straight}, {Foil}, {Dunce}.".format
(**StoogeDict))   # note ** "dictionary is external"
↳ The stooges are: Larry, Curley, Moe.
#  Select a single dictionary item
print("My favorite stooge is {Foil}.".format(**StoogeDict))
↳   My favorite stooge is Curley.
#   A single dictionary item using the {x[]} format and keyword
print("One stooge is {0[Foil]}.".format(StoogeDict))
↳  One stooge is Curley.
#  Select multiple items from mutiple dictionaries using keywords
print("It look like {0[Straight]} has a {1[1]} and a /
{1[2]} ".format(StoogeDict, PetDict ))
↳  It look like Larry has a cow and a dog
#   Refer to an object's attribute   # combine with a  class - very powerful
print("Its petals are bright {0.petals}.".format(Daisy))
↳  Its petals are bright yellow.
#  using !r and !s - example borrowed from
https://docs.python.org/3/library/string.html#formatspec
print("repr() shows quotes: {!r}; str() doesn't: {!s}".format /
('test1', 'test2'))   #best possible example we could imagine
↳  repr() shows quotes: 'test1'; str() doesn't: test2
```

Built-in String Format Methods

.capitalize() *-1st letter*
.center(width[, fillchar *default: space*])
.ljust(width[, fillchar]) *–justify*
.rjust(width[, fillchar]) *-right justify*
.upper() *-converted to uppercase*
.lower( ) *-convert to lowercase*
.strip([chars]) *-remove leading and trailing chars*
.lstrip([chars]) *–remove leading chars*
.rstrip([chars]) *-remove trailing chars*
.title() *-return a titlecased version*
.zfill(width) *– left fill with 0 to width*
.swapcase()

Template strings: A simple substitution function imported from the string module. (from string import Template) To keep it simple: (1) use the Template function to build a variable with named objects preceded by $ to be replaced with subs, (2) then use substitute(map object, **kwds) on that variable to define replacement values and build the string. (*$$ escapes and yields $*)

```
from string import Template
stoogeDict= {"L":"Larry", "M":"Moe", "C":"Curley"}
funnyStr= Template("$C handed the goat to $L and butted $M.")
funnyStr= funnyStr.substitute(stoogeDict)
print(funnyStr)
↳ Curley handed the goat to Larry and butted Moe.
....put together more suscintley
print(Template("$M and $C butted $L's goat.").substitute
(stoogeDict))
↳ Moe and Curley butted Larry's goat.
```

Template strings are easy, but VERY slow to execute!

.format dates: the easy way

```
import datetime
d = datetime.datetime(1948, 1, 19);
print('{:%m/%d/%Y}'.format(d))
↳   01/19/1948
```

New in version 3.6: f-strings - formatted string literals - prefixed with letters f or F

for more see: https://docs.python.org/3/reference/lexical_analysis.html#f-strings (2.4.3 Formatted string literals), ALSO see PEP 498

Text except }, {, or NULL - {{ & }} are replaced with single braces

"s" | "r" | "a" str(), repr(), ascii()

See mini-language described in **format()** Ex: format(string/number,'0=+20,.3f') explained on side 1.

f or F ● opening quote " ● [literal text] ● {replacement fields [:format string]} ● [literal text] ● closing quote "

f_expression : (conditional_expression | "*" or_expr) ("," conditional_expression | "," "*" or_expr)* [","] (NO BACKSLASHES IN EXPRESSION PARTS; **Must put LAMBDAS in parens ()**)

"{" f_expression ["!" conversion] [":" format_spec] "}"
*no backslashes *var*!s *var*!r *var*!a - *'var' is literal variable*

```
nametup = ("Larry","Curley","Moe")  # stuff for examples
myindex, Name, width, value, x = 2, 'Curley', 12, 12345.678, 75
state, subpart, subpart2 = 'Mississippi', 'iss', 'x'
lamstate = lambda state: state if subpart in state else "unknown"
intro_string = "Money: $"
import datetime
print(f"He said his name is {nametup[myindex]}.") #use index
print(f"{Name.upper(): ^10} center & caps!")  #sub and format
print(f"{intro_string}{value: {width},.2f} is cheap?") #note space
print(f"Going to {(lamstate(state)).upper():^20}!") #conditional
print(f"Bound for {state if subpart in state else 'unknown'}!")
print(f"Going to {state if subpart2 in state else 'unknown'}!")
print(f"Curley's IQ is about {x!r}.") #conversion example
print(f"Today is {datetime.date.today():%m/%d/%Y}.")
```

```
↳ He said his name is Moe.
↳   CURLEY  center & caps!
↳ Money: $  12,345.68 is cheap?
↳ Going to   MISSISSIPPI   !
↳ Bound for Mississippi!
↳ Going to unknown!
↳ Curley's IQ is about 75.
↳ Today is 04/16/2018.
```

Other notes: **formatter** - no notes, formatter module has been deprecated. **pprint module** - *Data pretty printer* - "provides a capability to "pretty-print" arbitrary Python data structures in a form which can be used as input to the interpreter." See:https://docs.python.org/3.6/library/pprint.html#module-pprint Beyond the scope of this toolbox document, but import and create object with

```
pp = pprint.PrettyPrinter(args)
args: indent, width, depth, stream,*,compact
```

then send object to output with command: pp.pprint(your object)

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