CSIT110

Fundamental Programming with Python

String Format

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In this lecture

Multi-line code statement

Escape sequence

String format

Numerical operations

Multi-line code statement

To end a statement in Python, you simply press Enter.

Therefore, this code will generate a syntax error:

```
subject_code = "CSCI111"
subject_mark = 80
subject_grade = "D"
result = "Subject result: "
 + subject_code
 + " mark " + str(subject_mark)
 + " grade " + subject_grade
print(result)
```

Python thinks that this is the end of the statement

Multi-line code statement

Use the backslash `\` to indicate that a statement is continued on the next line.

```
subject_code = "CSCI111"
subject_mark = 80
subject_grade = "D"

result = "Subject result: " \
  + subject_code \
  + " mark " + str(subject_mark) \
  + " grade " + subject_grade

print(result)
```

we can break a long line of code into multi-line

Multi-line code statement

Line continuation is automatic when the split comes while a statement is inside parenthesis (, brackets [or braces {

Therefore, this code is fine:

```
subject_code = "CSCI111"
subject_mark = 80
subject_grade = "D"
print(
  "Subject result: "
  + subject_code
  + " mark " + str(subject_mark)
  + " grade " + subject_grade
)
```

Sometimes, we should break a long line of code into multi-line to make it clearer

Escape Sequence

```
print("Welcome to Unimovies!")
print("Thursday July 30 at 7.15pm: Inside Out")
```

Program output:

```
Welcome to Unimovies!
Thursday July 30 at 7.15pm: Inside Out
```

Escape Sequence

```
print("Welcome to Unimovies!")
print("Thursday July 30 at 7.15pm: Inside Out")
```

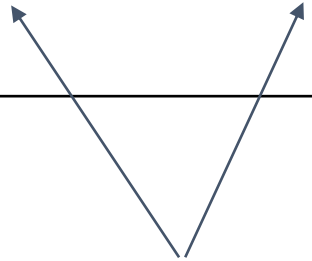
How do we write program for this output:

```
Welcome to Unimovies!
Thursday July 30 at 7.15pm: "Inside Out"
```

Escape Sequence

How about this program?

```
print("Welcome to Unimovies!")
print("Thursday July 30 at 7.15pm: "Inside Out"")
```



what is wrong with this code?

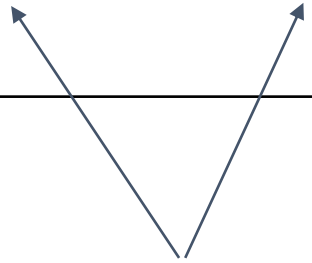
We want to write a program for this output:

```
Welcome to Unimovies!
Thursday July 30 at 7.15pm: "Inside Out"
```

Escape Sequence

The correct program

```
print("Welcome to Unimovies!")
print("Thursday July 30 at 7.15pm: \"Inside Out\"")
```



using escape sequence

Program output:

```
Welcome to Unimovies!
Thursday July 30 at 7.15pm: "Inside Out"
```

Escape Sequence

Escape Sequence	Meaning
\\	Backslash (\)
\'	Single quote (')
\"	Double quote (")
\n	New line
\t	Tab

Escape Sequence

```
print("Your details:\n")
print("\tName: \"John Smith\"")
print("\tSN: \"2012345\"")
print("\nEnrolment record:\n")
print("\tMATH101")
print("\tCSCI201")
```

Program output:

```
Your details:

    Name: "John Smith"
    SN:   "2012345"

Enrolment record:

    MATH101
    CSCI201
```

Escape Sequence

```
print("Escape sequence:")
print("\\n : Insert a newline.")
print("\\t : Insert a tab.")
print("\\\" : Insert a double quote character.")
print("\\\' : Insert a single quote character.")
print("\\\\ : Insert a backslash character.")
```

What is the output of this program?
Try it yourself!

String format

Formatting using `'…'.format()`

- `{}` – denotes where the variables will be

Formatting numbers in string

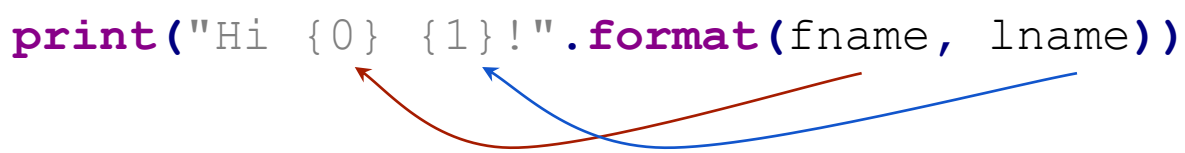
- `{:-8}` – sets minimum length of variable to 8 character
- `{:2.4%}` – displays a float to 4 decimal places

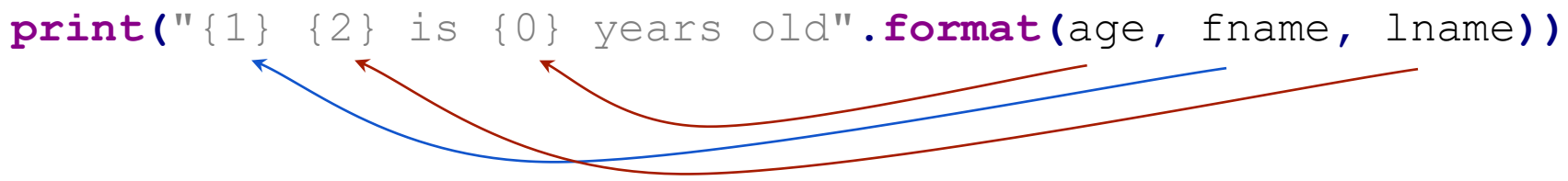
```
>>> for_votes = 2843493
>>> against_votes = 1223292
>>> percentage = for_votes / (for_votes + against_votes)
>>> print('{:-9} are for the notion ({:2.2%})'.format(for_votes,
            percentage))
```

```
2843493 are for the notion 69.92%
```

String format

```
fname = "John"
lname = "Smith"
age = 20
gpa_score = 3.2
print("Hi {0} {1}!".format(fname, lname))
print("{1} {2} is {0} years old".format(age, fname, lname))
print("His GPA score is {0:.2f}".format(gpa_score))
```





String format with alignment

```
print("Alkali metals:")
print()
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Element", "Symbol", "Atomic number", "Atomic weight"))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Lithium", "Li", 3, 6.94))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Sodium", "Na", 11, 22.990))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Potassium", "K", 19, 39.098))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Rubidium", "Rb", 37, 85.468))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Caesium", "Cs", 55, 132.905))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Francium", "Fr", 87, 223))
print() print("12345678901234567890123456789012345678901234567890123456789012345")
```

Program output

```
Alkali metals:

Element        Symbol              Atomic number          Atomic weight
Lithium        Li                         3                      6.94
Sodium         Na                        11                     22.99
Potassium      K                         19                    39.098
Rubidium       Rb                        37                    85.468
Caesium        Cs                        55                   132.905
Francium       Fr                        87                       223

12345678901234567890123456789012345678901234567890123456789012345
```

```
print("Alkali metals:")
print()
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Element", "Symbol", "Atomic number", "Atomic weight"))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Lithium", "Li", 3, 6.94))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Sodium", "Na", 11, 22.990))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Potassium", "K", 19, 39.098))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Rubidium", "Rb", 37, 85.468))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Caesium", "Cs", 55, 132.905))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Francium", "Fr", 87, 223))
print()
print("12345678901234567890123456789012345678901234567890123456789012345")
```

left alignment, using 15 spaces

```
Alkali metals:

Element        Symbol             Atomic number          Atomic weight
Lithium        Li                        3                      6.94
Sodium         Na                       11                     22.99
Potassium      K                        19                     39.098
Rubidium       Rb                       37                     85.468
Caesium        Cs                       55                    132.905
Francium       Fr                       87                       223

123456789012345678901234567890123456789012345678901234567890123456789012345
```

```
print("Alkali metals:")
print()
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Element", "Symbol", "Atomic number", "Atomic weight"))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Lithium", "Li", 3, 6.94))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Sodium", "Na", 11, 22.990))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Potassium", "K", 19, 39.098))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Rubidium", "Rb", 37, 85.468))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Caesium", "Cs", 55, 132.905))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Francium", "Fr", 87, 223))
print()
print("12345678901234567890123456789012345678901234567890123456789012345")
```

left alignment, using 10 spaces

```
Alkali metals:

Element        Symbol          Atomic number          Atomic weight
Lithium        Li                    3                      6.94
Sodium         Na                   11                     22.99
Potassium      K                    19                     39.098
Rubidium       Rb                   37                     85.468
Caesium        Cs                   55                    132.905
Francium       Fr                   87                       223

12345678901234567890123456789012345678901234567890123456789012345
```

```
print("Alkali metals:")
print()
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Element", "Symbol", "Atomic number", "Atomic weight"))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Lithium", "Li", 3, 6.94))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Sodium", "Na", 11, 22.990))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Potassium", "K", 19, 39.098))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Rubidium", "Rb", 37, 85.468))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Caesium", "Cs", 55, 132.905))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Francium", "Fr", 87, 223))
print()
print("12345678901234567890123456789012345678901234567890123456789012345")
```

centre alignment, using 25 spaces

```
Alkali metals:

Element        Symbol             Atomic number          Atomic weight
Lithium        Li                        3                      6.94
Sodium         Na                       11                     22.99
Potassium      K                        19                     39.098
Rubidium       Rb                       37                     85.468
Caesium        Cs                       55                    132.905
Francium       Fr                       87                       223

12345678901234567890123456789012345678901234567890123456789012345
```

```
print("Alkali metals:")
print()
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Element", "Symbol", "Atomic number", "Atomic weight"))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Lithium", "Li", 3, 6.94))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Sodium", "Na", 11, 22.990))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Potassium", "K", 19, 39.098))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Rubidium", "Rb", 37, 85.468))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Caesium", "Cs", 55, 132.905))
print("{0:<15}{1:<10}{2:^25}{3:>15}".format("Francium", "Fr", 87, 223))
print()
print("123456789012345678901234567890123456789012345678901234567890123456789012345")
```

right alignment, using 15 spaces

<	left
>	right
^	centre

```
Alkali metals:

Element         Symbol          Atomic number          Atomic weight
Lithium         Li                     3                       6.94
Sodium          Na                    11                      22.99
Potassium       K                     19                     39.098
Rubidium        Rb                    37                     85.468
Caesium         Cs                    55                    132.905
Francium        Fr                    87                        223

123456789012345678901234567890123456789012345678901234567890123456789012345
```

```
print("Alkali metals:")
print()
print("{0:<15}{1:<10}{2:^25}{3:>15.3f}".format("Element", "Symbol", "Atomic number", "Atomic weight"))
print("{0:<15}{1:<10}{2:^25}{3:>15.3f}".format("Lithium", "Li", 3, 6.94))
print("{0:<15}{1:<10}{2:^25}{3:>15.3f}".format("Sodium", "Na", 11, 22.990))
print("{0:<15}{1:<10}{2:^25}{3:>15.3f}".format("Potassium", "K", 19, 39.098))
print("{0:<15}{1:<10}{2:^25}{3:>15.3f}".format("Rubidium", "Rb", 37, 85.468))
print("{0:<15}{1:<10}{2:^25}{3:>15.3f}".format("Caesium", "Cs", 55, 132.905))
print("{0:<15}{1:<10}{2:^25}{3:>15.3f}".format("Francium", "Fr", 87, 223))
print()
print("12345678901234567890123456789012345678901234567890123456789012345")
```

we would like to display the Atomic Weight
as having exactly **3 digits** after the decimal places

```
Alkali metals:

Element        Symbol          Atomic number        Atomic weight
Lithium        Li                     3                    6.940
Sodium         Na                    11                   22.990
Potassium      K                     19                   39.098
Rubidium       Rb                    37                   85.468
Caesium        Cs                    55                  132.905
Francium       Fr                    87                  223.000

12345678901234567890123456789012345678901234567890123456789012345
```

```
print("Alkali metals:")
print()
print("{0:<15}{1:<10}{2:^25}{3:>15.4f}".format("Element", "Symbol", "Atomic number", "Atomic weight"))
print("{0:<15}{1:<10}{2:^25}{3:>15.4f}".format("Lithium", "Li", 3, 6.94))
print("{0:<15}{1:<10}{2:^25}{3:>15.4f}".format("Sodium", "Na", 11, 22.990))
print("{0:<15}{1:<10}{2:^25}{3:>15.4f}".format("Potassium", "K", 19, 39.098))
print("{0:<15}{1:<10}{2:^25}{3:>15.4f}".format("Rubidium", "Rb", 37, 85.468))
print("{0:<15}{1:<10}{2:^25}{3:>15.4f}".format("Caesium", "Cs", 55, 132.905))
print("{0:<15}{1:<10}{2:^25}{3:>15.4f}".format("Francium", "Fr", 87, 223))
print()
print("12345678901234567890123456789012345678901234567890123456789012345")
```

```
Alkali metals:

Element        Symbol            Atomic number          Atomic weight
Lithium        Li                       3                     6.9400
Sodium         Na                      11                    22.9900
Potassium      K                       19                    39.0980
Rubidium       Rb                      37                    85.4680
Caesium        Cs                      55                   132.9050
Francium       Fr                      87                   223.0000

12345678901234567890123456789012345678901234567890123456789012345
```

```
print("Alkali metals:")
print()
print("{0:<15}{1:<10}{2:^25}{3:>15.0f}".format("Element", "Symbol", "Atomic number", "Atomic weight"))
print("{0:<15}{1:<10}{2:^25}{3:>15.0f}".format("Lithium", "Li", 3, 6.94))
print("{0:<15}{1:<10}{2:^25}{3:>15.0f}".format("Sodium", "Na", 11, 22.990))
print("{0:<15}{1:<10}{2:^25}{3:>15.0f}".format("Potassium", "K", 19, 39.098))
print("{0:<15}{1:<10}{2:^25}{3:>15.0f}".format("Rubidium", "Rb", 37, 85.468))
print("{0:<15}{1:<10}{2:^25}{3:>15.0f}".format("Caesium", "Cs", 55, 132.905))
print("{0:<15}{1:<10}{2:^25}{3:>15.0f}".format("Francium", "Fr", 87, 223))
print()
print("12345678901234567890123456789012345678901234567890123456789012345")
```

```
Alkali metals:

Element         Symbol              Atomic number          Atomic weight
Lithium         Li                          3                      7
Sodium          Na                         11                     23
Potassium       K                          19                     39
Rubidium        Rb                         37                     85
Caesium         Cs                         55                    133
Francium        Fr                         87                    223

12345678901234567890123456789012345678901234567890123456789012345
```

String format with alignment

```
print("{0} x {1} = {2}".format(1, 5, 1*5))
print("{0} x {1} = {2}".format(2, 5, 2*5))
print("{0} x {1} = {2}".format(3, 5, 3*5))
print("{0} x {1} = {2}".format(4, 5, 4*5))
print("{0} x {1} = {2}".format(5, 5, 5*5))
print("{0} x {1} = {2}".format(6, 5, 6*5))
print("{0} x {1} = {2}".format(7, 5, 7*5))
print("{0} x {1} = {2}".format(8, 5, 8*5))
print("{0} x {1} = {2}".format(9, 5, 9*5))
print("{0} x {1} = {2}".format(10, 5, 10*5))
```

```
1 x 5 = 5
2 x 5 = 10
3 x 5 = 15
4 x 5 = 20
5 x 5 = 25
6 x 5 = 30
7 x 5 = 35
8 x 5 = 40
9 x 5 = 45
10 x 5 = 50
```

String format with alignment

```
print("{0:>2} x {1:>1} = {2:>2}".format(1, 5, 1*5))
print("{0:>2} x {1:>1} = {2:>2}".format(2, 5, 2*5))
print("{0:>2} x {1:>1} = {2:>2}".format(3, 5, 3*5))
print("{0:>2} x {1:>1} = {2:>2}".format(4, 5, 4*5))
print("{0:>2} x {1:>1} = {2:>2}".format(5, 5, 5*5))
print("{0:>2} x {1:>1} = {2:>2}".format(6, 5, 6*5))
print("{0:>2} x {1:>1} = {2:>2}".format(7, 5, 7*5))
print("{0:>2} x {1:>1} = {2:>2}".format(8, 5, 8*5))
print("{0:>2} x {1:>1} = {2:>2}".format(9, 5, 9*5))
print("{0:>2} x {1:>1} = {2:>2}".format(10, 5, 10*5))
```

we want a better output

```
 1 x 5 =  5
 2 x 5 = 10
 3 x 5 = 15
 4 x 5 = 20
 5 x 5 = 25
 6 x 5 = 30
 7 x 5 = 35
 8 x 5 = 40
 9 x 5 = 45
10 x 5 = 50
```

Arithmetic operators

+	Addition	3 + 5 = 8 3 + 5.0 = 8.0 1.2 + 3.4 = 4.6
-	Subtraction	5 - 2 = 3 5 - 2.0 = 3.0 6.5 - 1.2 = 5.3
*	Multiplication	5 * 2 = 10 5 * 2.0 = 10.0 6.5 * 1.3 = 8.45

Arithmetic operators

/	Division	10/2 = 5.0 10/4 = 2.5 10/2.0 = 5.0 10.0/1.2 = 8.3333
//	Floor division	10//2 = 5 10//4 = 2 10//2.0 = 5.0 10.0//1.2 = 8.0

What is the difference between Division and Floor division?

Arithmetic operators

/	Division	10/2 = 5.0 10/4 = 2.5 10/2.0 = 5.0 10.0/1.2 = 8.3333
//	Floor division	10//2 = 5 10//4 = 2 10//2.0 = 5.0 10.0//1.2 = 8.0

Note that division of two integers give a decimal number

```
10/2 = 5.0
```

So if we want integer result, we should use Floor division

```
10//2 = 5
```

Arithmetic operators

**	Exponent	10**2 = 100 10**4 = 10000 1.1**2 = 1.21 16**0.5 = 4.0 36**0.5 = 6.0

```
16**0.5    square root of 16
```

Arithmetic operators

%	Modulus	15%2 = 1 124%10 = 4 28%2 = 0 37%5 = 2 -15%2 = 1

when x is an odd number: x%2 = 1
when x is an even number: x%2 = 0

to find the last digit of positive integers:
124%10 = 4
23%10 = 3

+=	x += 2 is the same as x = x + 2
-=	x -= 2 is the same as x = x - 2
*=	x *= 2 is the same as x = x * 2
/=	x /= 2 is the same as x = x / 2
//=	x //= 2 is the same as x = x // 2
**=	x **= 2 is the same as x = x ** 2
%=	x %= 2 is the same as x = x % 2

Problem solving example

A shop sells a product item for $10, but makes a discount that 3 items only cost $20. Write a program to ask the user to enter the number of items they want to buy. Then the program displays the cost.

How much does it cost for 7 items?

How much does it cost for 12 items?

How much does it cost for 14 items?

Any questions?