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 multiple lines

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
)
```

Multi-line code statement

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

```
print(
  "Subject result: "
  + subject_code
  + " mark " + str(subject_mark)
  + " grade " + subject_grade
)
```

```
print("Subject result: " + subject_code  + " mark " +
str(subject_mark) + " grade " + subject_grade)
```

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")
```

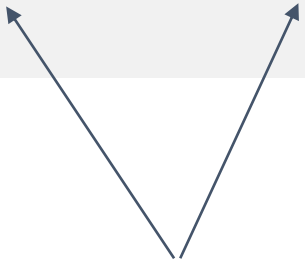
How do we write program for this output:

```
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?

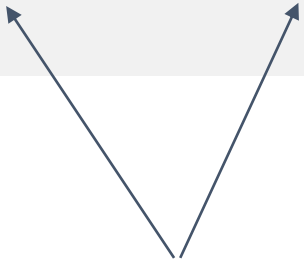
We want to write a program for this output:

```
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"
```

Alternatively

The correct program

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

Use single quotes to embed double quotes
and vice versa (See Slides 01PythonInputOutput slide 21.)

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 – f-string

Formatting using `f'…' or f"…"`

- `{}` – things in the curly brackets are interpreted as code

Formatting numbers in string

- `{:<8}` – sets minimum length of variable to 8 character
- `{:.4%}` – displays a float to 4 decimal places + converts number to a percentage

```
for_votes = 2843493
against_votes = 1223292
percentage = for_votes / (for_votes + against_votes)
print(f'{for_votes:<9} are for the notion ({percentage:.2%})')
```

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

String format with alignment

```
print("Alkali metals:")
print()
print(f'{"Element":<15}{"Symbol":<10}{"Atomic number":^25}{"Atomic weight":>15}')
print(f'{"Lithium":<15}{"Li":<10}{3:^25}{6.94:>15}')
print(f'{"Sodium":<15}{"Na":<10}{11:^25}{22.99:>15}')
print(f'{"Potassium":<15}{"K":<10}{19:^25}{39.098:>15}')
print(f'{"Rubidium":<15}{"Rb":<10}{37:^25}{85.468:>15}')
print(f'{"Caesium":<15}{"Cs":<10}{55:^25}{132.905:>15}')
print(f'{"Francium":<15}{"Fr":<10}{87:^25}{223:>15}')
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
```

String format with alignment

```
print("Alkali metals:")
print()
print(f'{"Element":<15}  {"Symbol":<10}{"Atomic number":^25}{"Atomic weight":>15}')
print(f'{"Lithium":<15}  {"Li":<10}     {3:^25}    {6.94:>15}')
print(f'{"Sodium":<15}   {"Na":<10}    {11:^25}   {22.99:>15}')
print(f'{"Potassium":<15} {"K":<10}    {19:^25} {39.098:>15}')
print(f'{"Rubidium":<15} {"Rb":<10}    {37:^25} {85.468:>15}')
print(f'{"Caesium":<15}  {"Cs":<10}    {55:^25}{132.905:>15}')
print(f'{"Francium":<15} {"Fr":<10}    {87:^25}    {223:>15}')
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
```

String format with alignment

```
print("Alkali metals:")
print()
print(f'{"Element"  :<15}{"Symbol":<10}{"Atomic number":^25}{"Atomic weight":>15}')
print(f'{"Lithium"  :<15}{"Li":<10}{3 :^25}{6.94   :>15}')
print(f'{"Sodium"   :<15}{"Na":<10}{11:^25}{22.99  :>15}')
print(f'{"Potassium":<15}{"K" :<10}{19:^25}{39.098 :>15}')
print(f'{"Rubidium" :<15}{"Rb":<10}{37:^25}{85.468 :>15}')
print(f'{"Caesium"  :<15}{"Cs":<10}{55:^25}{132.905:>15}')
print(f'{"Francium" :<15}{"Fr":<10}{87:^25}{223    :>15}')
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(f'{"Element"  :<15}{"Symbol":<10}{"Atomic number":^25}{"Atomic weight":>15}')
print(f'{"Lithium"  :<15}{"Li":<10}{3 :^25}{6.94   :>15}')
print(f'{"Sodium"   :<15}{"Na":<10}{11:^25}{22.99  :>15}')
print(f'{"Potassium":<15}{"K" :<10}{19:^25}{39.098 :>15}')
print(f'{"Rubidium" :<15}{"Rb":<10}{37:^25}{85.468 :>15}')
print(f'{"Caesium"  :<15}{"Cs":<10}{55:^25}{132.905:>15}')
print(f'{"Francium" :<15}{"Fr":<10}{87:^25}{223    :>15}')
print()
print("123456789012345678901234567890123456789012345678901234567890123456789012345")
```

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(f'{"Element"  :<15}{"Symbol":<10}{"Atomic number":^25}{"Atomic weight":>15}')
print(f'{"Lithium"  :<15}{"Li":<10}{3 :^25}{6.94   :>15}')
print(f'{"Sodium"   :<15}{"Na":<10}{11:^25}{22.99  :>15}')
print(f'{"Potassium":<15}{"K" :<10}{19:^25}{39.098 :>15}')
print(f'{"Rubidium" :<15}{"Rb":<10}{37:^25}{85.468 :>15}')
print(f'{"Caesium"  :<15}{"Cs":<10}{55:^25}{132.905:>15}')
print(f'{"Francium" :<15}{"Fr":<10}{87:^25}{223    :>15}')
print()
print("123456789012345678901234567890123456789012345678901234567890123456789012345")
```

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

1234567890123456789012345678901234567890123456789012345678901234567890123456789012345
```

```
print("Alkali metals:")
print()
print(f'{"Element"  :<15}{"Symbol":<10}{"Atomic number":^25}{"Atomic weight":>15}')
print(f'{"Lithium"  :<15}{"Li":<10}{3 :^25}{6.94   :>15}')
print(f'{"Sodium"   :<15}{"Na":<10}{11:^25}{22.99  :>15}')
print(f'{"Potassium":<15}{"K" :<10}{19:^25}{39.098 :>15}')
print(f'{"Rubidium" :<15}{"Rb":<10}{37:^25}{85.468 :>15}')
print(f'{"Caesium"  :<15}{"Cs":<10}{55:^25}{132.905:>15}')
print(f'{"Francium" :<15}{"Fr":<10}{87:^25}{223    :>15}')
print()
print("123456789012345678901234567890123456789012345678901234567890123456789012345")
```

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

123456789012345678901234567890123456789012345678901234567890123456789012345
```

```
print("Alkali metals:")
print()
print(f'{"Element"  :<15}{"Symbol":<10}{"Atomic number":^25}{"Atomic weight":>15}')
print(f'{"Lithium"  :<15}{"Li":<10}{3 :^25}{6.94   :>15}')
print(f'{"Sodium"   :<15}{"Na":<10}{11:^25}{22.99  :>15}')
print(f'{"Potassium":<15}{"K" :<10}{19:^25}{39.098 :>15}')
print(f'{"Rubidium" :<15}{"Rb":<10}{37:^25}{85.468 :>15}')
print(f'{"Caesium"  :<15}{"Cs":<10}{55:^25}{132.905:>15}')
print(f'{"Francium" :<15}{"Fr":<10}{87:^25}{223    :>15}')
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(f'{"Element"  :<15}{"Symbol":<10}{"Atomic number":^25}{"Atomic weight":>15}')
print(f'{"Lithium"  :<15}{"Li":<10}{3 :^25}{6.94   :>15.3f}')
print(f'{"Sodium"   :<15}{"Na":<10}{11:^25}{22.99  :>15.3f}')
print(f'{"Potassium":<15}{"K" :<10}{19:^25}{39.098 :>15.3f}')
print(f'{"Rubidium" :<15}{"Rb":<10}{37:^25}{85.468 :>15.3f}')
print(f'{"Caesium"  :<15}{"Cs":<10}{55:^25}{132.905:>15.3f}')
print(f'{"Francium" :<15}{"Fr":<10}{87:^25}{223    :>15.3f}')
print()
print("12345678901234567890123456789012345678901234567890123456789012345")
```

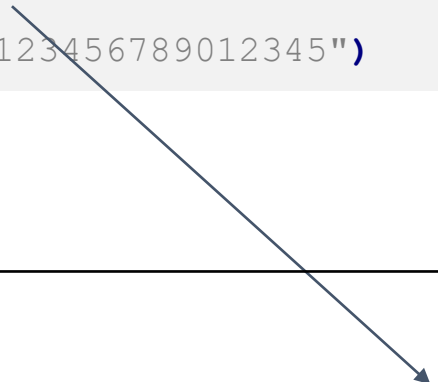
have exactly **3 digits** after the decimal places

```
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(f'{"Element"  :<15}{"Symbol":<10}{"Atomic number":^25}{"Atomic weight":>15}')
print(f'{"Lithium"  :<15}{"Li":<10}{3 :^25}{6.94    :>15.4f}')
print(f'{"Sodium"   :<15}{"Na":<10}{11:^25}{22.99   :>15.4f}')
print(f'{"Potassium":<15}{"K" :<10}{19:^25}{39.098  :>15.4f}')
print(f'{"Rubidium" :<15}{"Rb":<10}{37:^25}{85.468  :>15.4f}')
print(f'{"Caesium"  :<15}{"Cs":<10}{55:^25}{132.905:>15.4f}')
print(f'{"Francium" :<15}{"Fr":<10}{87:^25}{223    :>15.4f}')
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(f'{"Element"  :<15}{"Symbol":<10}{"Atomic number":^25}{"Atomic weight":>15}')
print(f'{"Lithium"  :<15}{"Li":<10}{3 :^25}{6.94    :>15.0f}')
print(f'{"Sodium"   :<15}{"Na":<10}{11:^25}{22.99   :>15.0f}')
print(f'{"Potassium":<15}{"K" :<10}{19:^25}{39.098  :>15.0f}')
print(f'{"Rubidium" :<15}{"Rb":<10}{37:^25}{85.468  :>15.0f}')
print(f'{"Caesium"  :<15}{"Cs":<10}{55:^25}{132.905:>15.0f}')
print(f'{"Francium" :<15}{"Fr":<10}{87:^25}{223    :>15.0f}')
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
```

Another example

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

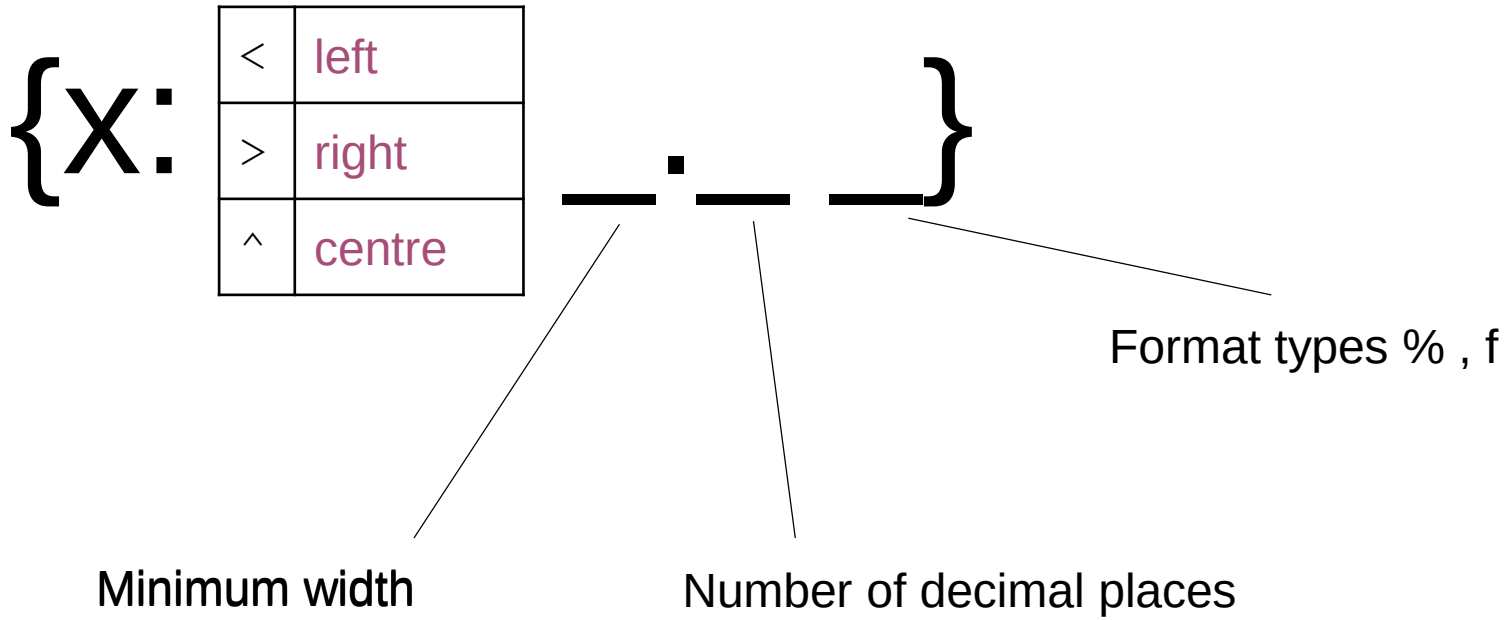
Another example

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

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
```

Recap


{x:
<
left
>
right
^
centre
__.__ __}
Format types % , f
Minimum width
Number of decimal places

Let’s take a break from str formatting

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
```

Assignment operators

`+=`	`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?