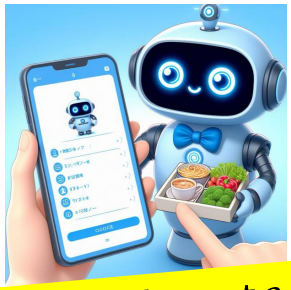
Interactive programs!



Letting the user choose…

(and more loopiness!)

Plus, if you've got a time machine…

Possible hardware

User input…

```
meters = input('How many m? ')
cm = meters * 100
print("That's", cm, 'cm.')
```

What will Python think?

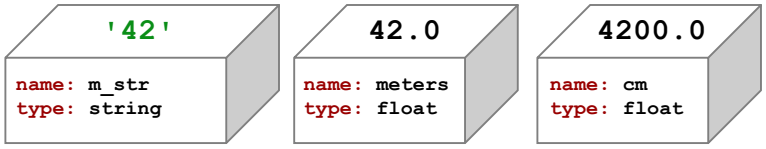
I think I like these units better than light years per year!

Fix #1: convert to the right type

```
m_str = input('How many m? ')

meters = float( m_str )

cm = meters * 100
print("That's", cm, 'cm.')
```



… but crash-able

Fix #2: convert and check

```
m_str = input('How many m? ')

try:
  meters = float( m_str )
except:
  print("What? Didn't compute!")
  print("Setting meters = 42")
  meters = 42.0

cm = meters * 100
print('That\'s', cm, 'cm.')
```

crash-able

try-except lets you try code and – if it crashes – *catch* an error and handle it

Fix #3: eval executes Python code!

```
m_str = input('How many m? ')

meters = eval( m_str )

cm = meters * 100
print('That is', cm, 'cm.')
```

What could go wrong here?

More loop control…

```
# Using return to return early from a function
def loopy0():
    for i in range(1,10):
        print(i)
        if i % 3 == 0:
            return
    print("All done!")
```

```
# Using continue to start a new iteration
def loopy2():
    for i in range(1,10):
        if i % 3 == 0:
            continue
        print(i)
    print("All done!")
```

```
# Using break to exit a loop early
def loopy1():
    for i in range(1,10):
        print(i)
        if i % 3 == 0:
            break
    print("All done!")
```

```
# Using pass to do nothing
def loopy3():
    for i in range(1,10):
        if i % 3 == 0:
            pass
        else:
            print(i)
    print("All done!")
```


Mystery sequences…

[-35, -24, -13, -2, 9, 20, 31, ?]

[26250, 5250, 1050, 210, ?]

[90123241791111, 93551622, 121074, 3111, ?]

[1, 11, 21, 1211, 111221, ?]

What's next?

I'm glad you asked!

A larger application …

```
def menu():
    """ prints our menu of options """
    print("(0) Continue")
    print("(1) Enter a new list")
    print("(2) Analyze")
    print("(9) Break (quit)")


def main():
    """ handles user input for our menu """

    while True:
        menu()
        uc = input('Which option? ')

        try:
            uc = int(uc)      # was it an int?
        except:
            continue          # back to the top!
```

Calls a helper function

Perhaps uc the reason for this?

```
def main():
    """ handles user input for our menu """
    L = [30,10,20]  # a starting list


    while True:
        menu()  # print menu
        uc = input('Which option? ')

        if uc == 9:
            break

        elif uc == 0:
            continue

        elif uc == 1:
            ... input ... eval ...

        elif uc == 2:
```

(9) Quit

(0) Continue

(1) Get new list

(2) Analyze !

... and so on ...

[0] Which line of code handles an input of **1** ?

[1] Which line of code handles an input of **5** ?

Big-picture view!

[2] Which line below handles an input of **7** ?

[3] What does input **3** print that **0** *does not*?

[4] What line of code runs after this **break** ? and **continue** ?

```
175  #
176  # example looping program
177  #
178
179  def menu():
180      """ a function that simply prints the menu """
181      print("\n")
182      print("(0) Continue!")
183      print("(1) Enter a new list")
184      print("(2) Analyze! (next element)")
185      print("(9) Break (Quit)")
186      print()
187
188  def predict(L):
189      """ predict ignores its input and returns
190          what the next element _should_ have been
191      """
192      return 42
193
194  def main():
195      """ the main user-interac
196      print("\n")
197      print("++++++++++++++++++++++++++")
198      print("Welcome to the PREDICTOR!")
199      print("++++++++++++++++++++++++++")
200      print()
201
202      secret_value = 4.2
203
204      L = [30,10,20]  # an initial list
205
206      while True:     # the user-interaction loop
207          print("\nThe list is", L)
208          menu()
209          uc = input( "Choose an option: " )
210
211          # "clean and check" the user's input
212          #
213          try:
214              uc = int(uc)   # make into an int!
215          except:
216              print("I didn't understand your input! Continuing...")
217              continue
218
219          # run the appropriate menu option
220          #
```

main function

secret_value

while True:

input

(option from menu)

[6a] What could you input for **newL** that would reach line 235?

[6b] how about reaching line 239?

```
220          #
221          if uc == 9:     # we want to quit
222              break       # leaves the while loop altogether
223
224          elif uc == 0:  # we want to continue...
225              continue   # goes back to the top of the while loop
226
227          elif uc == 1:  # we want to enter a new list
228              newL = input("Enter a new list: ")    # enter _something_
229
230              # "clean and check" the user's input
231              #
232              try:
233                  newL = eval(newL)   # eval runs Python's interpreter! Danger!
234                  if type(newL) != list:
235                      print("That wasn't of type list. Not changing L.")
236                  else:
237                      L = newL  # here, things were OK, so let's set our list, L
238              except:
239                  print("I didn't understand your input. Not changing L.")
240
241          elif uc == 2:        # predict and add the next element
242              n = predict(L)  # get the next element from the predict function
243              print("The next element is", n)
244              print("Adding it to your list...")
245              L = L + [n]      # and add it to the list
246
247          elif uc == 3:  # unannounced menu option!
248              pass       # this is the "nop" (do-nothing) statement in Python
249
250          elif uc == 4:  # unannounced menu option (slightly more interesting...)
251              m = find_min(L)
252              print("The minimum value in L is", m)
253
254          elif uc == 5:  # another unannounced menu option (even more interesting...)
255              minval, minloc = find_min_loc(L)
256              print("The minimum value in L is", minval, "at day #", minloc)
257
258          else:
259              print(uc, " ?      That's not on the menu!")
260
261          # last line of code while True loop
262          print("\nLooping back again... !\n")
263
264  print()
265  print("I predict... \n\n      ... that you'll be back!")
```

input

(new list)

[5] Where is predict defined?

Full-program menu-interaction example

[EC] How could a user learn the value of **secret_value** if they guessed that variable name *and* could run the program -- but *didn't have this source code*?

Try it!

Loops

Strategy: look for **repetition** + use it... .

Basic design strategies

Strategy: Look for **self-similarity** + use it... .

Recursion

```
def fac( N ):
    result = 1
    for x in range(1,N+1):
        result *= x
    return result
```

Is one more *reasonable* than the other?

```
def fac( N ):
    if N == 1:
        return 1
    else:
        return N*fac(N-1)
```


`for`: *two "loop patterns"*

```
L = [3, 15, 17, 7]
    0   1   2   3
```

L[0] L[1] L[2] L[3]

indices ("indexes")

```
for i in range(len(L)):
    total += L[i]
```

index-based loops
— access data indirectly,
(by its *index*)

elements

```
for x in L:
    total += x
```

element-based loops
— access data directly

hw8pr4: T. T. Securities (TTS)

Analyzing a sequence of ... ***anything!***

indices

```
    i
    day 0  day 1  day 2  day 3  day 4  day 5  day 6  day 7
L = [ 40,    80,    10,    30,    27,    52,    5,     15 ]
    x
```

elements

```
(0) Input a new list
(1) Print the current list
(2) Find the average price
(3) Find the standard deviation
(4) Find the min and its day
(5) Find the max and its day
(6) Your TTS investment plan
(9) Quit
Enter your choice:
```

tasks

hw8pr4: T. T. Securities (TTS)

Analyzing a sequence of ... ***stock prices?!***

*indices ~ **days***

```
    i
    day 0  day 1  day 2  day 3  day 4  day 5  day 6  day 7
L = [ 40,    80,    10,    30,    27,    52,    5,     15 ]
    x
```

*elements ~ **prices***

Implement a (text) menu:

```
(0) Input a new list
(1) Print the current list
(2) Find the average price
(3) Find the standard deviation
(4) Find the min and its day
(5) Find the max and its day
(6) Your TTS investment plan
(9) Quit
Enter your choice:
```

```
webbrowser.open_new_tab(url)
```

let's see...

T. T. Securities

"Taking the broke out of brokerage."

Software side ...

```
(0) Input a new list
(1) Print the current list
(2) Find the average price
(3) Find the standard deviation
(4) Find the min and its day
(5) Find the max and its day
(6) Your TTS investment plan
(9) Quit
Enter your choice:
```

Hardware side...

Investment analysis for the 21st century ... *and beyond*

One motivation for TT securities...

Market Summary > Zoom Video Communications Inc

66.94 USD

+4.94 (7.98%) ↑ past 5 years

Mar 21, 12:29 PM EDT • Disclaimer

1D | 5D | 1M | 6M | YTD | 1Y | 5Y | Max

Functions you'll write

All use loops...

Menu

```
(0) Input a new list
(1) Print the current list
(2) Find the average price
(3) Find the standard deviation
(4) Find the min and its day
(5) Find the max and its day
(6) Your TTS investment plan
(9) Quit
Enter your choice:
```

```
def average( L )
def stdev( L )
```

$$\sqrt{\frac{\sum_i (L[i] - L_{av})^2}{\text{len}(L)}}$$

```
def minprice( L )
def maxday( L )
```

also, max...

```
webbrowser.open_new_tab(url)
```


Min price

Just call `min` ?

day 0	day 1	day 2	day 3	day 4	day 5	day 6	day 7
40	80	10	30	27	52	5	15

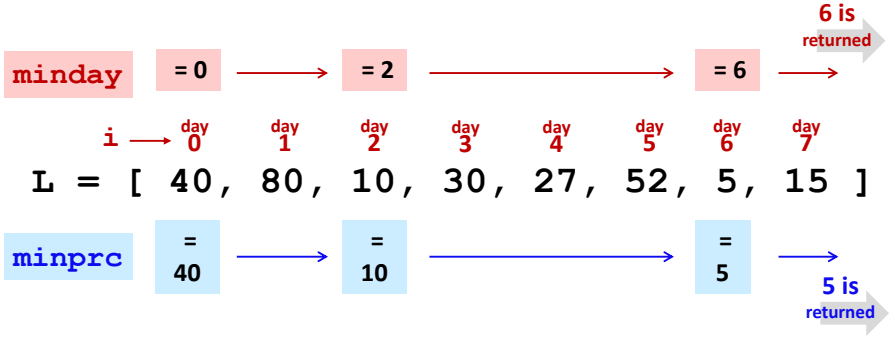
`L = [ 40, 80, 10, 30, 27, 52, 5, 15 ]`

`m =`

m is the "min so far"

What's the ***idea*** for finding the smallest (minimum) price?

track the value of the ***minimum so far*** as you loop over L




```
def min_prc_day( L ):
  minprc = L[0]
  minday = 0
  for i in range(len(L)):
    if
      
  return minprc, minday
```

track price *and* day

loop over locs (i)

check one and update both (as needed)

return *both*!

The TTS advantage!

What is the best TTS investment strategy here?

Your stock's prices: L = [40, 80, 10, 30, 27, 52, 5, 15]

Day	Price
0	40.0
1	80.0
2	10.0
3	30.0
4	27.0
5	52.0
6	5.0
7	15.0

```
(0) Input a new list
(1) Print the current list
(2) Find the average price
(3) Find the standard deviation
(4) Find the min and its day
(5) Find the max and its day
(6) Your TTS investment plan
(9) Quit
Enter your choice:
```

Important fine print:

 To make our business plan **realistic**, however, we only allow selling ***after*** buying.

The TTS advantage!

What is the best TTS investment strategy here?

Your stock's prices: L = [40, 80, 10, 30, 27, 52, 5, 15]

Day	Price
0	40.0
1	80.0
2	10.0
3	30.0
4	27.0
5	52.0
6	5.0
7	15.0

set max-so-far = 0

for each buy-day, **b**:

  for each sell-day, **s**:

    compute the *profit*

    if profit is > max-so-far:

      remember it in a variable!

return profit, its b-day, and s-day

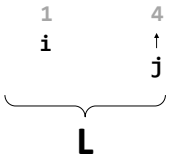
Important fine print:

 To make our business plan **realistic**, however, we only allow selling ***after*** buying.

Write **mindiff** to return the **smallest** abs. diff. between any two elements from **L.**

mindiff([42,3,100,-9,7])

4




```
def mindiff( L ):

  mdiff = abs(L[1]-L[0])

  for i in range(len(L)):
    for j in range(   ,len(L)):

      if

  return mdiff
```

Hint: This uses nested loops!

```
for i in range(4):
  for j in range(4):
```

Track the value of the *minimum so far* as you loop over **L twice**...

(blank)

Name(s) _____

The TTS-strategy:

[0] T.T. Securities's customer pledge:
"We select the day to buy and day to sell that ***will maximize your price-difference****..."**

Your stock's prices: L = [40, 80, 10, 30, 27, 52, 5, 15]

index	*element*
Day	**Price**
0	40.0
1	80.0
2	10.0
3	30.0
4	27.0
5	52.0
6	5.0
7	15.0

[1] What is the best TTS investment strategy for ***this list***, L?

[1b] Which day would you _buy_ (and at what price) ?

[1c] Which day would you _sell_ (and at what price) ?

[1d] What is the per-share profit in this best case? (!!!)

It's **NOT** 75!

for each buy-day, **b**:

    for each sell-day, **s**:

[2] How could ***nested loops*** help us find the *best* TTS strategy? *(a "code sketch...")*

this *all* seems sketch...

Important fine print:

*To make our business plan **realistic**, however, we only allow selling ***after*** buying.