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Week 6, Examples 2

#1.py

# In 8.py of the last lecture we saw a faster way (1.5n comparisons) to find
# min and max simultaneously. We will code that in Python in this module.

# Remember that finding min and max simultaneously in a single function
# using the simple
# method requires 2n comparisons (n for min, n for max) because we have to
# traverse
# the whole n element list.

# By pairing elements (smaller, larger) we compare only what we need to
# compare (i.e.,
# compare min with smaller, compare max with larger
# and thus cut down on part of the work. But in all, since we need to
# traverse the whole list,
# it will still be need 1.5n comparisons.

def even(n):
    if ((n%2)==0):   # tells if n is even or odd
        return(1)
    else:
        return(0)

def order (a,b):
    #returns the same pair as (smaller, larger), so
    # increasing order
    if (a < b):
        return(a,b)
    else:
        return(b,a)

def minandmax(list):
    # returns (min,max) of the whole list

    n = len(list)

    if (even(n)):
        min,max = order(list[0], list[1])
        index = 2           #we start with a pair (min,max), n is even

    else:
        min,max = list[0],list[0]
        index = 1           # both min and max refer to the first item in
list, n is odd

```python
while (index < len(list)):
    smaller, larger = order(list[index], list[index+1])
    if (smaller < min):
        min = smaller
    if (larger > max):
        max = larger
    index = index + 2
return(min, max)
```

def main():
    evenlist = [ -1, 7, 12, 99, -18, 73, 14, 12]  #8 elements
    oddlist = [6, 22, -100, 27, 202, -101, 81, 11, 0]  #9 elements
    min, max = minandmax(evenlist)
    print(" evenlist: min = ", min, " max = ", max)
    print(" ")
    min, max = minandmax(oddlist)
    print(" oddlist: min = ", min, " max = ", max)
main()
```

#____________________________________________________________
#2.py
# A for-loop is a DEFINITE loop (you know the stop and start when it begins)
# Let’s use our unusual on-the-fly mean and variance calculation from last week. We will
# insert it in loops. To begin with, a for loop that accepts data from keyboard.
```python
def wait():
    x = input()
    print(" ")

def main():

    n = eval(input("Please enter the number of data points you want to work with: "))
    print("\n\n")
    print("____________________for loop 

                  ")
    for i in range(n):

        newdata = float(input("Enter a number: "))

        if (i == 0):
            mean = newdata
            var = 0
            print(" The value of loop-index i is ",i)
        else:
            mean = ((n-1)/n)*mean + newdata/n
            var = ((n-1)/n)*var + ((newdata - mean)*(newdata-mean))/(n-1)
            # The above variance formula divides by n instead of (n-1)
            # and so is "biased"
            print(" The value of loop-index i is ",i)

        print("____________________end for loop 

                   ")

    wait()

    print(" number of data points input = ",n)
    var = (var*n)/(n-1)  #correction to get "unbiased" variance
    print("       mean: {0:0.4f}".format(mean))
    print("  variance :{0:0.4f}".format(var))

main()

#____________________________________________________________
#3.py
# Now, without any specific computation let's look at how a WHILE-LOOP works
# We'll call functions to execute simple loops, so we understand

def whileloop_sum(n):
```
sum = 0

i = 0  # initialize the loop index before entering the while-loop

while (i <= n):  # loop will be entered ONLY if the condition is true; tested on each pass
    print("while-loop index i = ", i)
    sum = sum + i
    i = i + 1  # DO NOT FORGET TO INCREMENT WHILE LOOP INDEX!

return(sum)

def forloop_sum(n):
    sum = 0

    for i in range(n+1):  # notice for the "definite loop" settings are automatic
        print("for-loop index i = ", i)
        sum = sum + i  # for-loop automatically increments the for-loop index i

    return(sum)

def badwhileloop_sum(n):
    sum = 0

    i = 0  # initialize the loop index before entering the while-loop

    while (i <= n):  # loop will be entered ONLY if the condition is true; tested on each pass
        print("while-loop index i = ", i)
        sum = sum + i

    # i = i + 1  # supposed we forget to increment loop index (it's commented out)

    # now the while-loop condition becomes true forever and it will run forever
```python
return(sum)

def wait():
    x = input()
    print("_______________________________________________ ")

def main():
    wait()
    answer1 = whileloop_sum(10)
    print(" (First ) while-loop sum is ",answer1)
    wait()
    answer2 = forloop_sum(10)
    print(" (Second) for-loop sum is ",answer2)
    wait()
    answer3 = forloop_sum(-2)  # note we are calling for-loop with endpoint
                            # n = -1
                            # observe how it tests if index is in range before entering
    print(" (Third) for-loop sum is ",answer3)
    wait()
    print("Look inside the while loop in the function call")
    print("to see why the Fourth loop runs forever (infinite loop)")
    answer4 = badwhileloop_sum(10)  # note we are calling for-loop with
end point n = -1
                                    # observe how it tests if index is in
range before entering
```
# the function will loop forever and not return, so
# kill the program with a CTRL-C

print(" Bad while-loop sum is ", answer4)

main()

#
#4.py
#
# Example of an INDEFINITE loop --- the user tells you when to stop looping
#
# Let's use our unusual on-the-fly mean and variance calculation from last week.

def wait():
x = input()
print(" ")

def main():

    done = 0  # using 0 to mean FALSE, so not done is TRUE

    n = 0  # counts data

    print("____________________while loop ______________________________________")

    while (not done):

        if (n == 0):
            newdata = eval(input(" Enter a number: "))
            n = 1
            mean = newdata
            var = 0
            print(" The value of loop-index i is ", n)

        else:
            newdata = eval(input(" Enter another number: "))
            n = n + 1
            mean = ((n-1)/n)*mean + newdata/n
            var = ((n-1)/n)*var + ((newdata - mean)*(newdata-mean))/(n-1)
            # The above variance formula divides by n instead of (n-1)
            # and so is "biased"
print(" The value of loop-index i is ", n)

# Now check if the user wants to input more data

resp = str(input("Another data item? (Y/N, y/n, yes/no, etc): "))

if (resp[0] != "y") and (resp[0] != "Y"):
    print(" done")
done = 1 # did not get "y" or "Y", so loop is done

print("____________________end while loop ______________________")

wait()

print(" number of data points input = ", n)
if (n > 1):
    var = (var*n)/(n-1) # correction to get "unbiased" variance
print(" mean: {0:0.4f}".format(mean))
print(" variance :{0:0.4f}".format(var))

main()

# 5.py

# Example of a SENTINEL loop --- the user inputs a "sentinel" to tell you when to stop looping

# A "sentinel" is a special value (a negative number, if all your data is positive;
# or a number that you are sure will not occur in your data, such as 99999999)

# Let's use our unusual on-the-fly mean and variance calculation from last week.

def wait():
    x = input()
    print(" ")

def main():
    done = 0 # using 0 to mean FALSE, so not done is TRUE
    n = 0 # counts data items
newdata = eval(input(" Enter a number (or a negative number to quit): "))

if (newdata < 0):
    done = 1

print("____________________while loop________________________________________")

while (not done):

    if (n == 0):
        mean = newdata
        var = 0
        # update the count
        n = n + 1
        print(" The value of loop-index i is ", n)
    else:
        newdata = eval(input(" Enter another number (or a negative number to quit): "))
        if (newdata < 0):
            done = 1
        else:
            n = n + 1  #just read in a new data item
            mean = ((n-1)/n)*mean + newdata/n
            var = ((n-1)/n)*var + ((newdata - mean)*(newdata-mean))/(n-1)
            # The above variance formula divides by n instead of (n-1)
            # and so is "biased"
            print(" The value of loop-index i is ", n)

print("____________________end while loop________________________________________")

wait()

print(" number of data points input = ", n)
if (n > 0) :
    var = (var*n)/(n-1)  #correction to get "unbiased" variance
    print(" mean: {0:0.4f}".format(mean))
    print(" variance :{0:0.4f}".format(var))

main()
# Using numbers as sentinels can cause problems if the sentinel can also be real data.
# For example, if your data includes negative numbers, and your sentinel is negative.

# We can use a special character string such as the empty string " " as a sentinel

# Let's use our unusual on-the-fly mean and variance calculation from last week.

def wait():
    x = input()
    print(" ")

def main():

    done = 0  # using 0 to mean FALSE, so not done is TRUE
    n = 0    # counts data items

    newdata = input(" Enter a number (or hit Return key to quit): ")

    if (str(newdata) == "):
        done = 1              # got an empty string

    print("____________________while loop
____________________")

    while (not done):

        if (n == 0):
            mean = float(newdata)
            var = 0
            # update the count
            n = n + 1
            print(" The value of loop-index i is ", n)
        else:
            newdata = input(" Enter another number (or hit Return key to quit): ")
            print("string = ", str(newdata))
if (str(newdata) == ""):  
    done = 1                # got an empty string
else:
    newdata = float(newdata)
    n = n + 1              # just read in a new data item
    mean = ((n-1)/n)*mean + newdata/n
    var = ((n-1)/n)*var + ((newdata -
    mean)*(newdata-mean))/(n-1)  
    # The above variance formula divides by n instead of (n-1)  
    # and so is "biased"

    print(" The value of loop-index i is ",n)

    print("____________________end while loop
     ___________________")

    wait()

    print(" number of data points input = ",n)
    if (n > 0) :
        var = (var*n)/(n-1)          # correction to get "unbiased"
        variance
        print("      mean: {0:0.4f}".format(mean))
        print(" variance :{0:0.4f}".format(var))

main()

# ___________________________________________________________________________

save the first set of numbers below in file "even.txt" and the second set of  
numbers in file "odd.txt"  
(that is, files with an even number and an odd number of entries,  
respectively)  
The following program will use these files. You can change the file names if  
you like.

7
-22
1
18
-16
12
74
-11
55
99
# 7.py

# Let's use our min/max function with data from a file

```python
def even(n):
    if ((n%2)==0):  # tells if n is even or odd
        return(1)
    else:
        return(0)

def order (a,b):
    # returns the same pair as (smaller, larger), so increasing order
    if (a < b):
        return(a,b)
    else:
        return(b,a)

def minandmax(list):  # returns (min,max) of the whole list

    n = len(list)

    if (even(n)):
        min,max = order(list[0], list[1])
        index = 2  # we start with a pair (min,max), n is even
    else:
        min,max = list[0],list[0]
        index = 1  # both min and max refer to the first item in list, n is odd

    while (index < len(list)):
```

```
smaller, larger = order([list[index], list[index+1]])

if (smaller < min):
    min = smaller

if (larger > max):
    max = larger

index = index + 2

return (min, max)

def main():
    fname = input("Datafile for list with an even number of items? ")
infile = open(fname, "r")

evenlist = []

for line in infile:
    evenlist.append(float(line))

print(evenlist)

min, max = minandmax(evenlist)

print(" evenlist: min = ", min, " max = ", max)

print(" ")
infile.close()

fname = input("Datafile for list with an odd number of items? ")
infile = open(fname, "r")

oddlist = []

for line in infile:
    oddlist.append(float(line))

print(oddlist)

min, max = minandmax(oddlist)

print(" oddlist: min = ", min, " max = ", max)

infile.close()
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