Slide Type Slide

# 1 ICS 104 - Introduction to Programming in Python and C

## 1.1 Loops - Lab 2

Slide Type Slide

## 2 Lab Objectives

- To understand nested loops
- To process strings

Slide Type Slide

## 3 Worked Example#1

Slide Type Fragment

- Problem Statement: It is common to repeatedly read and process multiple groups of values. Write a program that can be used to compute the average exam grade for multiple students. Each student has the same number of exam grades.

Slide Type Slide

- **Step 1:** Understand the problem.
  - To compute the average exam grade for one student, we must enter and tally all of the grades for that student.
  - This can be done with a loop.
  - But we need to compute the average grade for multiple students.

Slide Type Fragment

- Thus, computing an individual student's average grade must be repeated for each student in the course.
- This requires a nested loop.
- The inner loop will process the grades for one student and the outer loop will repeat the process for each student

Slide Type Fragment

```
Prompt user for the number of exams.
Repeat for each student
    Process the student's exam grades.
    Print the student's exam average.
```

Slide Type Slide

- **Step 2:** Compute the average grade for one student.
  - Because we know how many grades need to be read, we can use a for loop with the range function:

```
total score = 0
for i in range(1, numExams + 1) :
    Read the next exam score.
    Add the exam score to the total score.
Compute the exam average.
Print the exam average.
```

Slide Type Slide

- **Step 3:** Repeat the process for each student
  - Because we are computing the average exam grade for multiple students, we must repeat the task in Step 2 for each student.
  - Because we do not know how many students there are, we will use a while loop with a sentinel value. But what should the sentinel be?
  - For simplicity, it can be based on a simple yes or no question.
  - After the user enters the grades for a student, we can prompt the user whether they wish to enter grades for another student:

Slide Type Fragment

- `moreGrades = input("Enter exam grades for another student (Y/N)? ")`
  `moreGrades = moreGrades.upper()`

Slide Type Slide

- A no response serves as the terminating condition. Thus, each time the user enters "Y" at the prompt, the loop will be executed again.

Slide Type Fragment

- We will use a loop condition set to moreGrades == "Y", and initialize the loop variable to contain the string "Y".
- This allows the loop to be executed at least once so the user can enter the grades for the first student before being prompted for a yes or no response.

Slide Type Fragment

```
moreGrades = "Y"
while moreGrades == "Y" :
    Enter grades for one student.
    Compute average grade for one student.
    moreGrades = input("Enter exam grades for another student (Y/N)? ")
    moreGrades = moreGrades.upper()
```

In [1]:

Slide Type Slide

```
#%%writefile StudentID-Section.py
##
```

```
#  This program computes the average exam grade for multiple students.
#

# Obtain the number of exam grades per student.
numExams = int(input("How many exam grades does each student have? "))

# Initialize moreGrades to a non-sentinel value.
moreGrades = "Y"

# Compute average exam grades until the user wants to stop.
while moreGrades == "Y" :

   # Compute the average grade for one student.
    print("Enter the exam grades.")
    total = 0
    for i in range(1, numExams + 1) :
      score = int(input("Exam %d: " % i))   # Prompt for each exam grade.
      total = total + score

    average = total / numExams
    print("The average is %.2f" % average)

    # Prompt as to whether the user wants to enter grades for another student.
    moreGrades = input("Enter exam grades for another student (Y/N)? ")
    moreGrades = moreGrades.upper()
```

```
How many exam grades does each student have? 4
Enter the exam grades.
Exam 1: 9
Exam 2: 9
Exam 3: 8
Exam 4: 7
The average is 8.25
Enter exam grades for another student (Y/N)? y
Enter the exam grades.
Exam 1: 6
Exam 2: 7
Exam 3: 8
Exam 4: 9
The average is 7.50
Enter exam grades for another student (Y/N)? n
```

Slide Type: Slide

# 4 Exercises

Slide Type: -

- Exercise # 1: Write a program that prints a multiplication table, like this:

```
 1   2   3   4   5   6   7   8   9  10
 2   4   6   8  10  12  14  16  18  20
 3   6   9  12  15  18  21  24  27  30
 4   8  12  16  20  24  28  32  36  40
 5  10  15  20  25  30  35  40  45  50
 6  12  18  24  30  36  42  48  54  60
 7  14  21  28  35  42  49  56  63  70
 8  16  24  32  40  48  56  64  72  80
 9  18  27  36  45  54  63  72  81  90
10  20  30  40  50  60  70  80  90 100
```

In [2]:

Slide Type: -

```
# Exercise # 1 - Source Code
numMax = 10
numWanted = int(input("Enter number:"))

for i in range(1,numMax+1):
    for j in range(1,numWanted+1):
        print(i*j,end="\t")
    print()

```

```
Enter number:10
1	2	3	4	5	6	7	8	9	10
2	4	6	8	10	12	14	16	18	20
3	6	9	12	15	18	21	24	27	30
4	8	12	16	20	24	28	32	36	40
5	10	15	20	25	30	35	40	45	50
6	12	18	24	30	36	42	48	54	60
7	14	21	28	35	42	49	56	63	70
8	16	24	32	40	48	56	64	72	80
9	18	27	36	45	54	63	72	81	90
10	20	30	40	50	60	70	80	90	100
```

Slide Type: Slide

Exercise # 2: Write a program that given a collection of $N$ numbers will find the largest value, its frequency and the average of the $N$ numbers.

- Get the value of $N$ from the user.
- If $N \leq 0$, display an appropriate error message and terminate the program; otherwise
- Read the values as entered from the user. (If $N = 5$, then there are 5 values the user is going to enter).
- Find the largest, its frequency (how many times it is repeated) and the average of these $N$ values.
- **Hint**: To find the largest value, read the first value **before the loop** then assume that this first value entered by the user is the largest value. **Within the loop** compare the assumed largest value with other values **read inside the loop** and change the largest value accordingly.

**Sample Runs**

Slide Type: -

```
Enter how many values to consider: 4
Enter value 1: -3
Enter value 2: -10
Enter value 3: -7
Enter value 4: -3
Maximum value=  -3
It's frequency is 2
Average = -5.75
```

Slide Type: -

```
Enter how many values to consider: -2
Wrong input. Input must be > 0
```

Slide Type: -

```
Enter how many values to consider: 7
Enter value 1: 4
Enter value 2: 3
Enter value 3: 2
```

```
Enter value 3: 2
Enter value 4: 1
Enter value 5: 2
Enter value 6: 3
Enter value 7: 5
Maximum value=  5
It's frequency is 1
Average = 2.86
```

In [2]:

Slide Type -

```python
### Exercise # 2 - Source Code
times = int(input("Enter how many values to consider: "))
if times>0:
    ValueMax = int(input("Enter value 1: "))
    COUNT = 1
    total = ValueMax

    for i in range(times-1):
        i = str(i+2)
        Value = int(input("Enter value "+i+": "))
        if  Value > ValueMax:
            ValueMax = Value
            total = total + ValueMax
        elif Value == ValueMax:
            COUNT +=1
            total = total + ValueMax
        else:
            total = total + Value
    Average = total / times
    print("Maximum value=",ValueMax)
    print("It's frequency is",COUNT)
    print("Average = %0.2f" % Average)

else:
    print("Woron input. Input must be > 0")
```

```
Enter how many values to consider: 5
Enter value 1: 1
Enter value 2: 2
Enter value 3: 3
Enter value 4: 4
Enter value 5: 5
Maximum value= 5
It's frequency is 1
Average = 3.00
```

Slide Type Slide

- Exercise # 3: Write a program that reads a word and prints each character of the word on a separate line, with each letter located one position to the right of the previous letter. For example, if the user provides the input "Harry", the program prints

```
Enter a word: Harry
H
 a
  r
   r
    y
```

In [12]:

Slide Type -

```python
# Exercise # 3 - Source Code
name =  input("Enter a word: ")
for i in range(len(name)):
    for j in range(i):
        print(" ",end="")
    print(name[i])
```

```
Enter a word: Harry
H
 a
  r
   r
    y
```

Slide Type Slide

- Exercise # 4: Write a program that reads a word and prints the number of vowels in the word. For this exercise, assume that a e i o u y are vowels. For example, if the user provides the input "Harry", the program prints 2 vowels.
  **Sample Runs**

Slide Type -

```
Enter a word: Accounting
There are 4 vowels in Accounting
```

Slide Type -

```
Enter a word: LG
There are 0 vowels in LG
```

In [64]:

Slide Type -

```python
# Exercises # 4 - Source Code
word = input("Enter a word: ")
Vowels = "aeiouy"
count = 0
for i in range(len(word)):
    if word[i].lower() in Vowels:
        count += 1
print("There are",count,"Vowels in",word)
```

```
Enter a word: LG
There are 0 Vowels in LG
```

Slide Type Slide

- Exercise # 5: Translate the following pseudocode for randomly permuting the characters in a string into Python program.

```
Read a word.
Repeat len(word) times
```

Repeat len(word) times
    Pick a random position i in the word, but not the last position.
    Pick a random position j > i in the word.
    Swap the letters at positions j and i.
Print the word.

To swap the letters, construct substrings as follows:


Then replace the string with

```
first + word[j] + middle + word[i] + last
```

**Sample Runs**

Slide Type -

```
Enter a word: california
The random permuation is flraioanci
```

Slide Type -

```
Enter a word: california
The random permuation is ialrfocain
```

Slide Type -

```
Enter a word: Jet
The random permuation is teJ
```

Slide Type -

```
Enter a word: Jet
The random permuation is eJt
```

In [1]:

Slide Type -

```
# Exercise # 5 - Source Code
from random import randint
WORD = input("Enter a word: ")
for x in range(len(WORD)):
    j = randint(1,len(WORD)-1)
    i = randint(0,j-1)
    first = WORD[:i]
    middle= WORD[i+1:j]
    last  = WORD[j+1:]
    randomName = first+WORD[j]+middle+WORD[i]+last
print("The random permuation is " + randomName)
```

```
Enter a word: OMAR
The random permuation is AMOR
```

In [ ]:

Slide Type

```

```