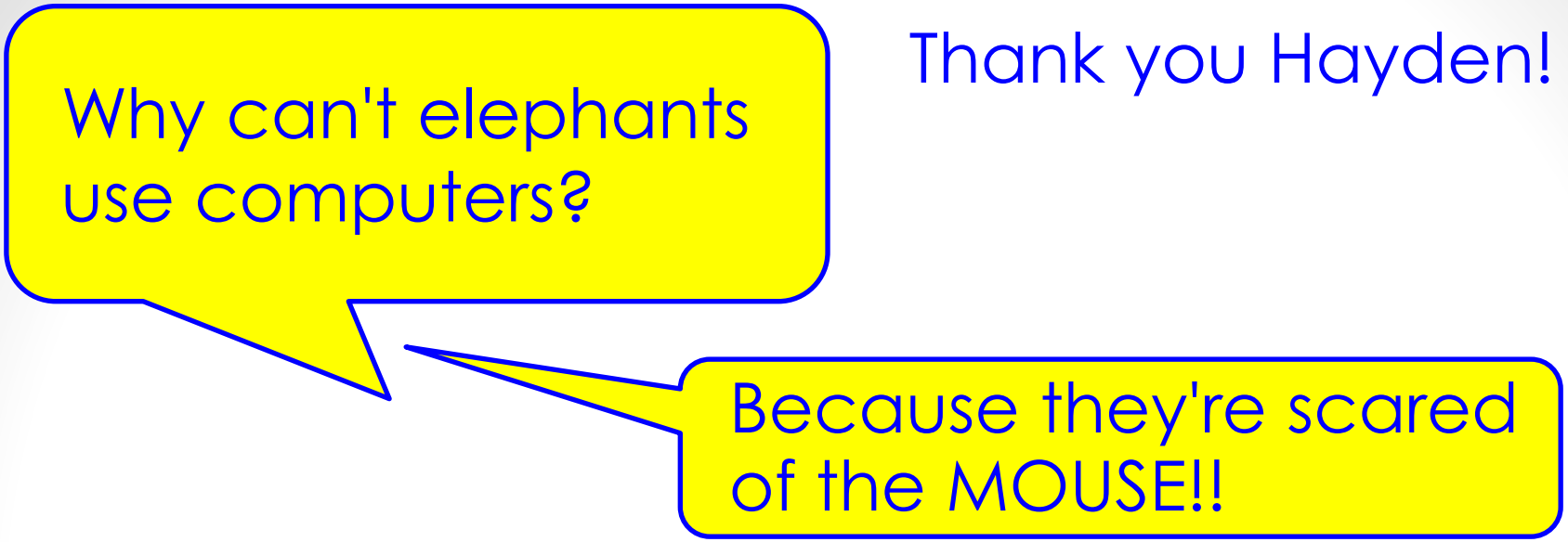
Thank you Hayden!



Source: https://heresajoke.com/computer-jokes/

CMPT 120

Lecture 12 – Cryptography and Encryption –
The realm of secret codes
Python – Functions and `while` Loop

Last Lecture

- Continued investigating the topic of **Cryptography and Encryption**
  1. By finishing the implementation of our **OddEvenEncryption** program
     - Implementing the **encryption algorithm**
  2. By adding **decryption** to our **OddEvenEncryption** program

- Introduced **functions**

Today's Menu

- Finish implementing the **decryption algorithm**
- Create **functions** in our **OddEvenEncryption** program
  - `Encrypt()`
  - `Decrypt()`
- We shall look at another way of iterating Python statements in our programs
  - `while` loop

Transposition algorithm **odd&even** decryption

Definition: Algorithm that shuffles elements from their original positions in a sequence to new positions!

Transposition algorithm **odd&even**:

1. Find the middle of **cipherMsg**
2. Store the first half of **cipherMsg** into **String3**
   - This first half contains the characters originally located in **odd positions** of **plainMsg**
3. Store the last half of **cipherMsg** into **String4**
   - This second half contains the characters originally located in **even positions** of **plainMsg**
4. Lastly, merge **String3** with **String4** to recreate **plainMsg**

So far …

… we have used functions that were already built into Python by calling them

- Built-in functions (some came from modules)
  - For example: `print(…), input(…), type(…), random.randint(1, 10)`
- Built-in methods
  - For example: `<string>.upper( ), <string>.isalpha( )`

Why creating functions?

Functions make our program easier to …

1. Implement and test -> Incremental development
   - Dividing a long program into functions allows us to implement, test and debug the parts one at a time and then assemble them into a working program
2. Read
   - Encapsulate code fragment that does one thing (functionality) in **one** location, i.e., a "module" (function) and give this location a descriptive name
3. Modify
   - If we need to make a change to our program, we know where to go, i.e., where to find the code fragment we need to change
4. Reuse
   - Once we write, test and debug a function, we can reuse it in other programs that need this particular functionality
5. No more repeated code
   - Functions can make a program smaller by eliminating repeated code - Repeated code is very error-prone

Review - Function

Syntax of function definition

def -> means "here is the **definition** of a function"

Function header

```
def  <functionName>( [parameter(s)] ) :
        < 1 or more statements >
        return [expression]
```

Body of the function

1 return statement

- **GPS** about **<functionName>**
  - Function name is descriptive -> it describes the purpose of the function
  - Function name syntax: same as for variable name syntax

Execution flow and functions

- Let's examine what happens to the **execution flow** when we call functions
  - using the **Python code visualizer**

From last lecture: Your turn

- **Problem Statement:**
  - Write a program that **encrypts** and **decrypts** messages using the **transposition algorithm odd&even**
- **Requirement:**
  - Your program must go on encrypting and decrypting messages entered by the user until the user only presses the ENTER key.

Review - Syntax of a `while` loop

```
<stmt before loop:
        initialize condition variable>
while <Boolean condition> :
    <first statement to be repeated>
    <second statement to be repeated>
    ...
    <stmt: modify condition variable>
<statement outside (after) the loop>
```

Review - Syntax of a `while` loop

```
<stmt: before loop: initialize condition variable >
while <Boolean condition> :
      <first statement to be repeated>
      <second statement to be repeated>
      ...
      <stmt: modify condition variable>
<statement outside (after) the loop>
```

- **Important** – About Indentation
  - ***Statements inside the loop*** (i.e., statements executed at each iteration of the loop) are the statements indented with respect to the `while` keyword
  - ***Statements outside the loop*** (before and after the loop) are the statements that are **not** indented with respect to the `while` keyword – these statements are considered to be at the same level of indentation as the `while` loop

Review - Difference between `while` and `for` loops

```
<stmt: initialize condition variable>
while <Boolean condition> :
    <first statement to be repeated>
    <second statement to be repeated>
    ...
    <stmt: modify condition variable>
<statement outside (after) the loop>
```

```
<statement outside (before) the loop>
for <iterating variable> in <sequence> :
    <first statement to be repeated>
    <second statement to be repeated>
    ...
    <last statement to be repeated>
<statement outside (after) the loop>
```

When best to use a **`while`** loop

- If there is a **condition** that will occur during the execution of our program and when this condition occurs, the execution of a set of statements in our program needs to stop, then we use a **`while loop`**
- This **condition** is often called a **sentinel** or **flag**
  - Examples:
    - User termination
      - User presses the ENTER key without typing anything -> empty string
      - User enters yes/no or some special value
      - User selects 'X' to eXit from a menu (menu-driven program)
    - Occurrence of an error
    - Reading data from a file -> EOF

When best to use a `for` loop

- If we know exactly **how many times** we must iterate a set of statements in our program, then we use a `for loop`

GPS: We cannot use a `while` loop with a `True` condition:

```
while True :
    break
    exit()
```

Can you see why?

Next Lecture

- Practice Exam #3