CIRCUITS AND ELECTRONICS : ANALOG AND DIGITAL

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Instructions: Copy and complete this document and post a link to it from your class site. (One form per group)
If you are an experienced coder and your partner also has some experience, you can skip to the end of the document and solve any one of the challenges.

Value: 5 points

- 3 pts : Exercises are correct or at least attempted for full credit.
- 2 pt : Relatively equal participation from both partners

Learning Goals:

- Lists
- For loops
- Dictionaries
- While loops
- Python Errors

Need to set up Replit? Refer back to exercise set one

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1. Lists

A list is a variable with multiple values - see an example

```
my_schedule = ["D&T", "English", "Biology"]
```

Using repl.it create the following:

- Make a list with six people's names in this class.
- Print the list

Screenshot your code here:

```
list_of_people = ["Raj", "Christopher",
"Niam", "Frank", "Emory", "Cillian"]

print(list_of_people)
```

Next: Lists allow you to access specific data items. Example

- Print only the odd number of items in your list. (Keep in mind that the first item is 0, not 1

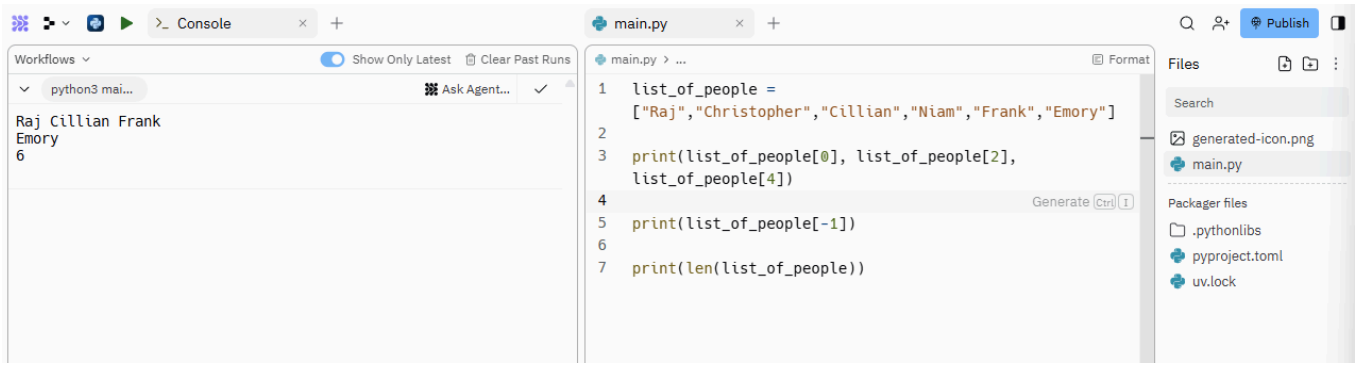
no need to use a loop yet)

- In another line, print only the last item in your list by negative indexing.

Sometimes, you might need to know how long a list is. See how to print the length of a list

- Add a third line to print the length of your list.

Screenshot your code here:

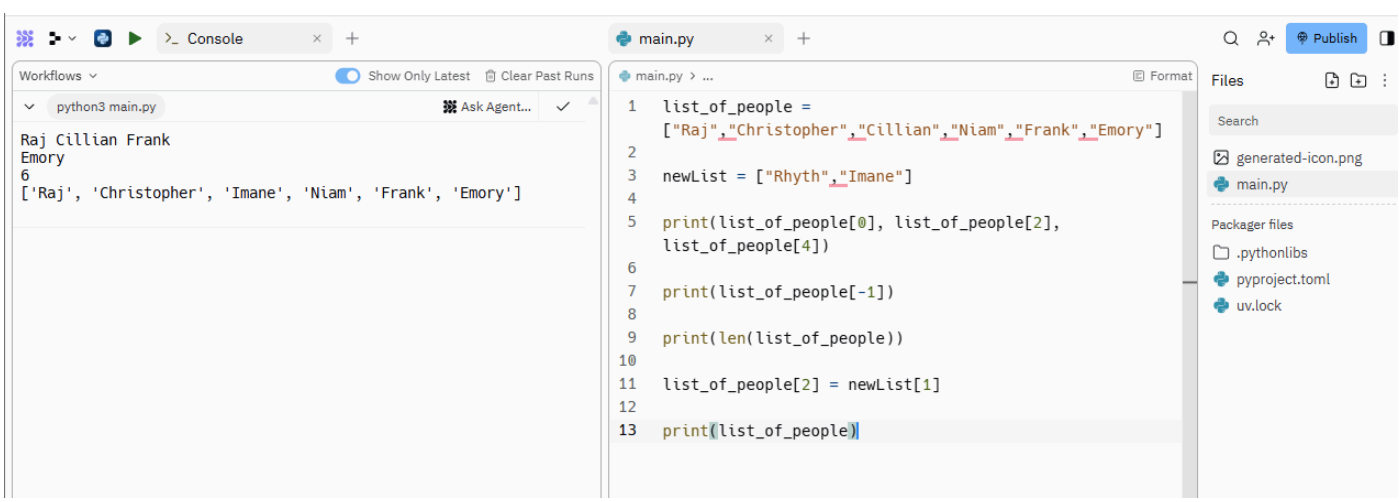


You can change items in a list. See how here
You can also add or insert items to a list. See how here

Using repl.it create the following:

- Keep using the list of names you had in the last sketch.
- Create a NEW list with two new names from the class
- Using list indexing, CHANGE the center of the original list to include the 2nd of the two new names and print the revised list

Screenshot your code here:



OPTIONAL: There's so much more you can do with lists. Look at the common list methods

- Create a list of favorite shows
- Create a sketch that uses reverse, sort, and one other method.
- Print out the results

Screenshot your code here:

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2. For Loops

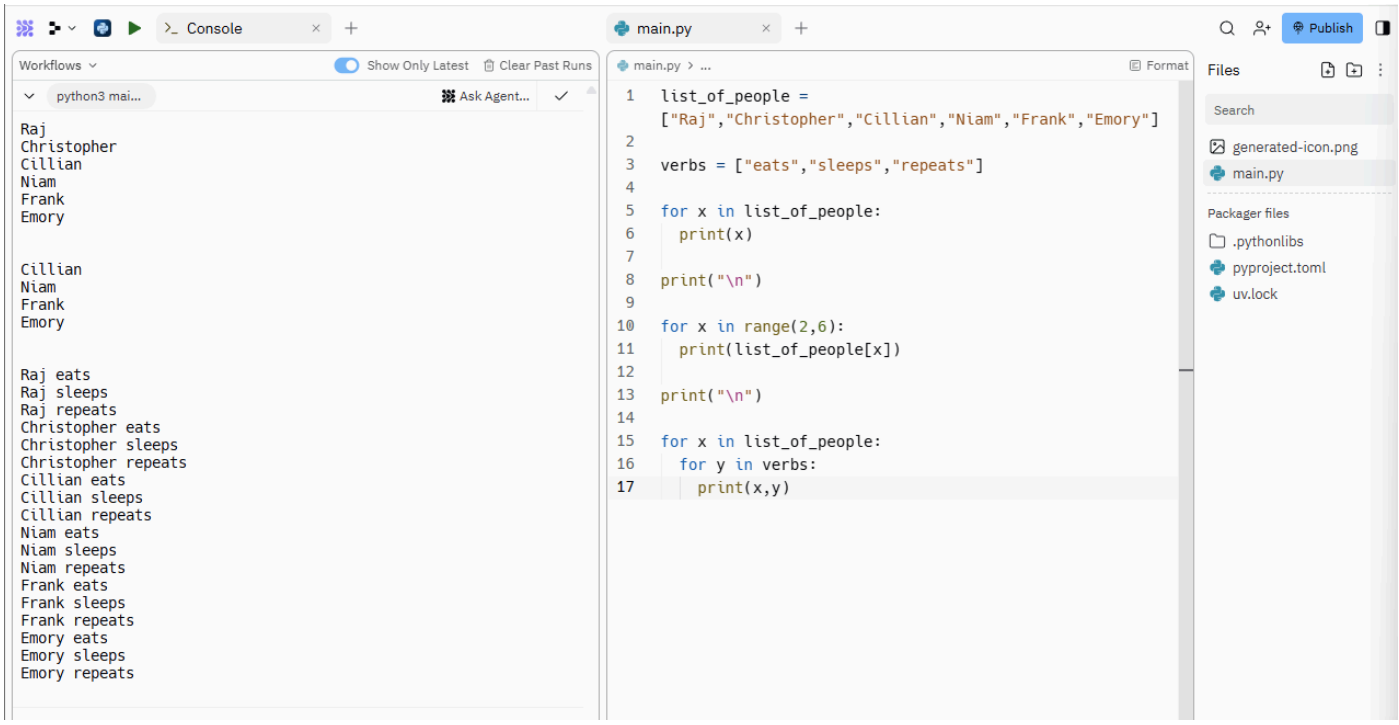
Look at these examples using a for loop to print everything in a list.

Using repl.it create the following:

- Use the original list of 6 names or create a fresh list of 6 names
- Create a 2nd list with present-tense verbs that these people might engage in. (example: "jumps")
- Use a for loop to print your list of first names
- Use the range function command to print only names indexed at 2 - 5
- Use a nested loop to print each first name along with each of the verbs.
  Example:Z

```
Alice jumps
Alice runs
Bob jumps
Bob runs
```

Screenshot your code here:



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3. Dictionaries

Dictionaries allow for more complex data objects in which data is represented in key:value pairs. [Read here]

```
city_worker = {
  "name": "Elmer",
  "career": "Plumber",
  "age": 99,
  "Avaliable": True
}
```

Create a dictionary that has data about a movie you and your partner like. Create at least five key:value pairs for the dictionary.

- Print the entire dictionary.
- Print only two Key Values from your dictionary. [example]

Screenshot your code here:

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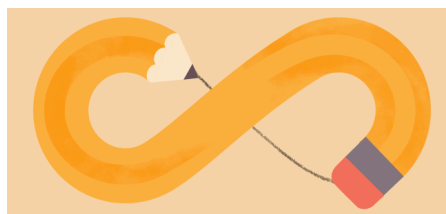
4. While Loops



"While loops" do something as long as a condition is true. [See examples here]
We will frequently use the statement "while True" to repeat something forever.

Try this:

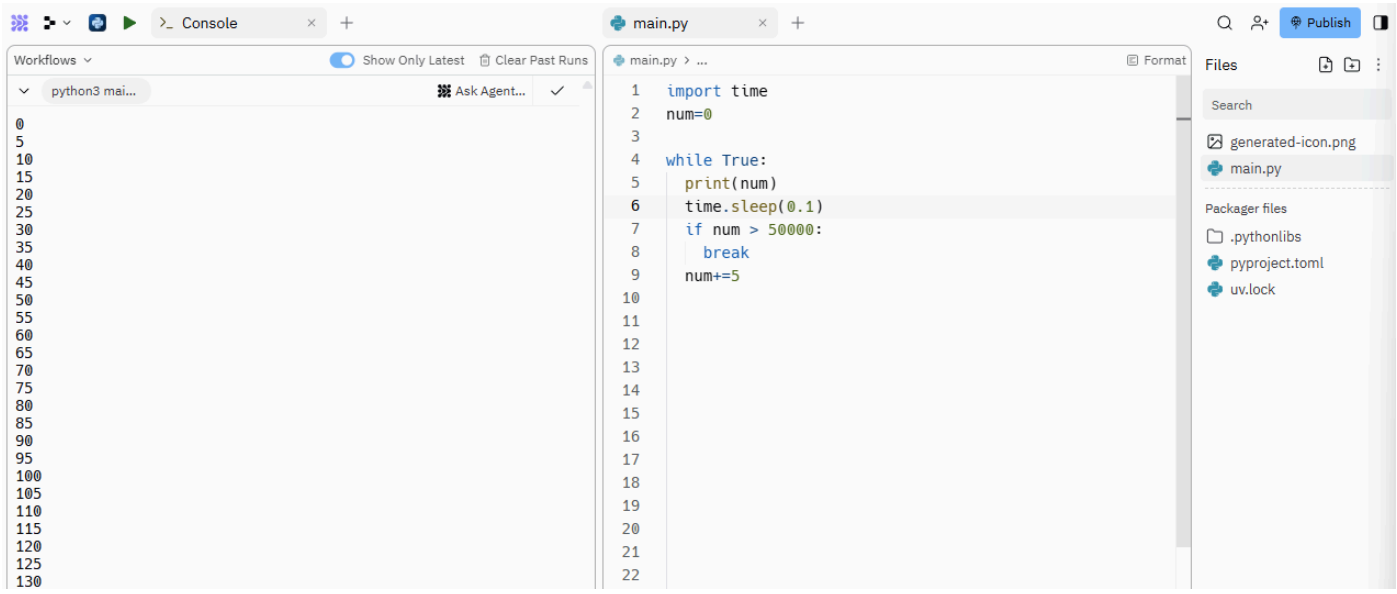
```
import time
hello=1

while True:
  print(hello)
  hello=hello+1
  time.sleep(1)
```

hello+=1 is a shorter and equivalent way to write which statement above?

hello=hello+1

- Create a similar sketch where you count up by fives. When the number is over 50,000 you use the break command to end the loop.

Screenshot your code here:



5. Python Errors

Python errors can be helpful [if you know what they mean](#).

- Paste this code into replit.

```
city_worker = {
  "name": "Elmer",
  "career": "Plumber",
  "age": 99,
  "Available": True
}

print(city_worker["mood"])
```

What error do you get, and what does it mean:

Mood is not defined in the dictionary.

- Paste this code into replit. What error do you get and what does it mean:

```
rat=100
cats = 52
print(dogs)
```

What error do you get, and what does it mean:

The variable dogs is not defined so there is nothing to print.

- Paste this code into replit. What error do you get and what does it mean:

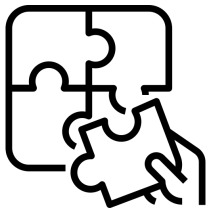
```
word = "hello"
for x in range(0,6):
  print(word[x])
```

What error do you get, and what does it mean:

The word "hello" only has 5 letters so in the range (0,6), 5 and 6 do not refer to anything.

For those who have some extra time:

Can you figure out any part of this puzzle?



1. Find an online resource that shows you how to randomize values.
2. Create a list of seven kinds of cereal.
3. Create a list of seven people.
4. Create a loop that grabs a random name and a random cereal to make a sentence that say "This [person] ate [cereal name] today."
5. Have this loop run every 0.5 seconds
6. Add a couple of statements at the end that keep track of how many times the loop has run, and print it in a statement of some kind.

Optional: Keep track of how many times a cereal is eaten. If a cereal comes up 5 times, can you remove it from the list because the box is empty? Hint: This means your random number will need to be based on the length of the list and not on a static number.

Screenshot your code here:

Python exercises for folks with some prior knowledge:

1. Enhanced List Manipulation

Create a program that does the following:

- Initialize a list of 10 random integers between 1 and 100.
- Use a list comprehension to create a new list containing only the even numbers from the original list.
- Sort the new list in descending order.
- Use a lambda function with the `filter()` method to remove numbers divisible by 3 from the sorted list.
- Print the final result.

2. Dictionary and List Combination

Create a program that:

- Defines a dictionary where keys are names of countries and values are lists of their top 3 cities by population.
- Implements a function that takes a country name as input and returns a formatted string listing its cities.
- Uses a try-except block to handle cases where the input country is not in the dictionary.
- Incorporates a while loop to allow multiple queries until the user decides to exit.

3. Advanced For Loop with Enumerate

Write a program that:

- Creates a list of tuples, where each tuple contains a student's name and their grade (0-100).
- Uses a for loop with `enumerate()` to print each student's name, grade, and their position in the class (assuming the list is sorted by grade in descending order).
- Calculates and prints the class average grade.

4. File I/O and Dictionary Manipulation

Create a program that:

- Reads a text file containing words and their frequencies (one word-frequency pair per line).

- Creates a dictionary from this data.
- Implements functions to:
    - Add new words or update the frequencies of existing words.
    - Remove words below a certain frequency threshold.
    - Find the top N most frequent words.
- Writes the updated dictionary back to a new file in a formatted manner.

5. Object-Oriented Programming Challenge

Design a simple bank account system:

- Create a `BankAccount` class with attributes for account number, holder name, and balance.
- Implement methods for deposit, withdrawal, and balance inquiry.
- Create a `SavingsAccount` subclass that inherits from `BankAccount` and includes an interest rate attribute. SavingsAccount should inherit from BankAccount
- Override the withdrawal method in `SavingsAccount` to enforce a minimum balance.
- Create a few accounts and demonstrate the functionality of your classes.

6. Error Handling and Debugging

Provide a piece of code with multiple intentional errors (syntax errors, logical errors, and runtime errors).

- Identify each error type.
- Explain the cause of each error.
- Fix the errors and make the code run correctly.

This exercise will enhance debugging skills and deepen understanding of Python's error messages.