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L1/Python - Language Features/What is a computer programming language?

Language is a tool for **communication.**

In this learning program, we use English to give instructions and share information with learners.

Similarly, **computer programming languages** communicate with computers by providing instructions.

These Programming languages help us represent data like numbers, text, and images and also provide instructions to work with that data.

You don't need to be a computer science expert or a math genius to write a computer program. If you understand basic logic, you can write computer programs easily.

There are many programming languages available. In our course, we will learn a programming language called **Python.**

Python is an interpreted, high-level programming language for general-purpose programming.

In English, to greet someone, you say **"Hello!"**. Similarly in Spanish, one would say "**Hola!**".

For example, if we want the computer to display a greeting message, we provide instructions in a computer programming language. In **Python** we provide instructions in the below format

```
print("Hello!")
```

The above text is called **source code** or simply **code**. Since it is written in **Python**, it is called **Python** code.

The above code represents a simple **Python** program which prints "**Hello!**".

In the above case, we have provided some instructions in a computer programming language to the computer to display a greeting message. This sequence of instructions is called a **program**.

[Note : Some of the words which appear in purple with an underline are links. Click to know more about them.]

Select all the correct statements from the given options

- [ ] Only those who study Computer Science Engineering or a related subject in college can learn and write computer programs.
- [x] The sequence of instructions (in the form of source code) written in a computer programming language is called a computer program.
- [ ] One needs to be a genius in Maths to become a computer programmer.
- [ ] Computer Programming languages are very hard to learn.

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L1/Python - Language Features/The genesis of Python

The **Python** programming language was developed in the **1980s** by **Guido Van Rossum** at Centrum Wiskunde & Informatica (CWI) in the Netherlands as a successor to the **ABC** language (itself inspired by **SETL**), capable of exception handling and interfacing with the Amoeba operating system.

Programming languages can be classified into the below three categories:

- **Low-level programming languages:** It involves communication with the system in binary format , consisting of `0's` and `1's`, which can be directly executed. These languages provide instructions that can be used to perform low-level operations such as memory management. An example of such language is **Assembly Language**.
- **High-level programming language:** In this, the communication with system occurs in the form of **text (usually in English)**, which is easily readable and understandable by humans. Examples of such Languages include Ada, JavaScript, **Python**, Ruby etc.
- **Middle-level programming languages:** These are the languages which support both **low-level** and **high-level** features. These are also written in human readable text. They typically use tools like **compilers** to convert the human readable instructions (high-level language constructs) into low-level executable code (usually in binary format). Eg: C, C++, Java, etc,.

Python versions:

Guido Van Rossum published the first version of Python code (**Python 0.9.0**) at **alt.sources** in February 1991. This release included exception handling, functions and the core data types.

Python 1.0 released in January 1994. It included filters, map, reduce and lambda.

Python 2.0 released in October 2000. Features include list comprehension and garbage collection with reference cycles.

Python 3.0 released in December 2008. This release removed duplicate constructs and modules, but it was not backward compatible with previous versions..

Do not panic. The features mentioned above will be discussed in detail in the later sections.

Python can be used for creating computer applications, computer games or even for testing microchips.

- [ ] **Python** programming language was developed in the year 1999.
- [ ] **Python** is a middle-level programming language.
- [x] The **Python** programming language evolved through many versions.
- [ ] **Python** language was created by Sundar Pichai.

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L1/Python - Language Features/Python Program Life Cycle

The instructions (called source code) written in **Python** programming language can be executed in two modes:

1. **Interactive mode:** In this mode, lines of code are directly written and executed in the **Python interpreter** shell, which instantaneously provides the results.
2. **Normal or script mode:** In this mode the source code is saved to a file with **.py** extension, and the file is executed by the **Python interpreter**.

As we learn **Python** in this course, we'll use the regular way of running code, which means writing our code in files with a **.py** ending. This is the practice adopted for building extensive programs in **Python.**

For example, **calculator.py** is called a **Python** source file.

The **Python** program statements have to be entered and saved in a file through a text editor, and then the file has to be executed to produce results.

If there are any errors in **Python** code then the system will let you know so that you can fix them.

There are two types of errors:

- **Syntax errors**
- **Runtime errors**.

1) Syntax errors are like grammatical errors in English. They occur when the defined rules are not followed.
For example:

```
prin("Hello World")
```

The **Python** interpreter generates the following syntax error as it did not find a name **prin** (as the correct method name is **print**).

```
Traceback (most recent call last):
  File "", line 1, in
NameError: name 'prin' is not defined
```

When we change the code to print("Hello World"), the Python interpreter would print the output as follows

- [ ] Python programs can be executed only by writing them into files.
- [x] Python source code is written and saved in a file with **.py** extension.
- [ ] Runtime errors are like grammatical errors in English.

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L1/Python - Language Features/Difference between Compiler and Interpreter

Compiler	Interpreter
Compiler takes entire program as input	Interpreter takes single instruction as input
Intermediate object code is generated	No Intermediate object code is generated
Conditional control statements execute faster	Conditional control statements are slower in execution
Memory Requirement is More(Since Object code is generated)	Memory Requirement is Less
Program need not be compiled every time	Every time higher level program is converted into lower level program
Errors are displayed after entire program is checked	Errors are displayed for every instruction interpreted (if any)
Example : C compiler	Example : Python

Select all the correct statements from the given options.

- [ ] In **Python** intermediate code is generated.
- [x] Compiler takes entire block of code as a single unit to check and identify the errors in program.
- [ ] Memory allocation is more in **Python** due to creation of Object code at the time of source code compilation.

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L1/Python - Language Features/High level language categories

The Programming Languages are divided into following categories:

1. **Interpreted languages**: These languages are executed line by line by an interpreter without prior compilation.
   Examples include Python, Ruby, and JavaScript.
2. **Functional languages**: These languages treat functions as important parts and promote a way of programming where functions are used a lot. These are designed on the concept of mathematical functions that use conditional expressions and recursion to perform computation.
   Examples include Haskell, Lisp, and Erlang.
3. **Compiled languages**: These languages require compilation before execution. The source code is transformed into machine code or intermediate code.
   Examples include C, C++, and Rust.
4. **Procedural languages**: These languages follow a procedural programming paradigm, emphasizing the use of procedures or functions to organize code.
   Examples include C, Pascal, and Fortran.
5. **Scripting languages**: These languages are interpreted and used for automating tasks and scripting applications.
   Examples include Python, Perl, Ruby, and Bash.
6. **Markup languages**: These languages are used to define and present structured data. They are not traditional programming languages but play a crucial role in data representation.
   Examples include HTML, XML, and JSON.
7. **Concurrency-Oriented languages**: These languages are designed to handle multiple tasks at the same time, working together.
   Examples include Go (Golang) and Erlang.
8. **Object-Oriented languages**: These languages support object-oriented programming (OOP) concepts like classes, objects, inheritance, and polymorphism.
   Examples include Java, C++, C#, and Python.

Select all the correct statements from the given options.

- [ ] Concurrent Programming is technique that provides execution of operations sequentially.
- [x] XML is an example of markup programming language.
- [x] Scripting languages are used to automate frequently executing tasks.
- [ ] A compiled programming language is one which interprets and executes statement before the next statement is interpreted.
- [x] Functional programming language uses conditional expressions and recursion to perform computation.

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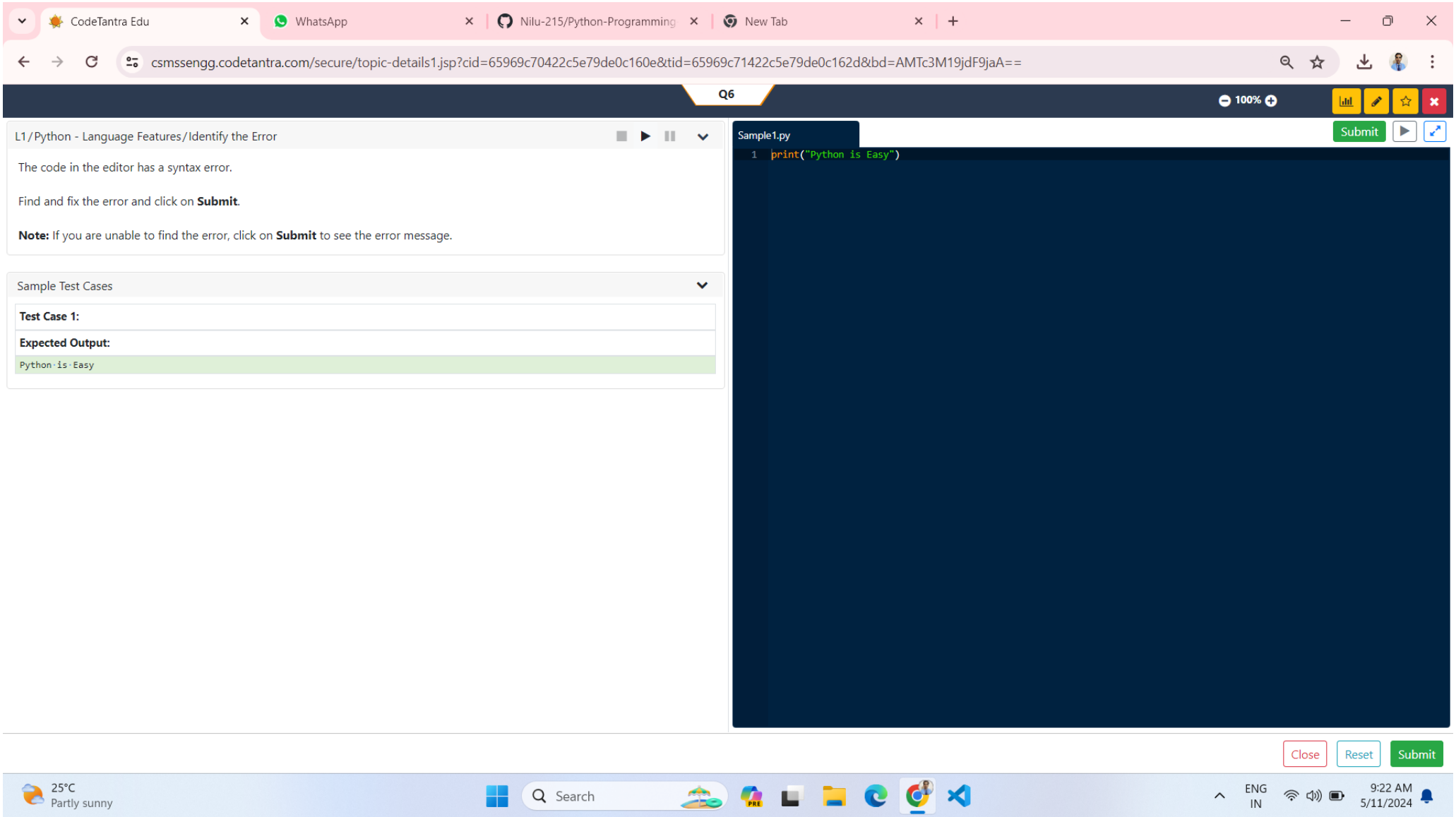
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L1/Python - Language Features/Identify the Error
The code in the editor has a syntax error.
Find and fix the error and click on Submit.
Note: If you are unable to find the error, click on Submit to see the error message.
Sample Test Cases
Test Case 1:
Expected Output:
Python is Easy
Sample1.py
Submit
1 print("Python is Easy")
Close
Reset
Submit
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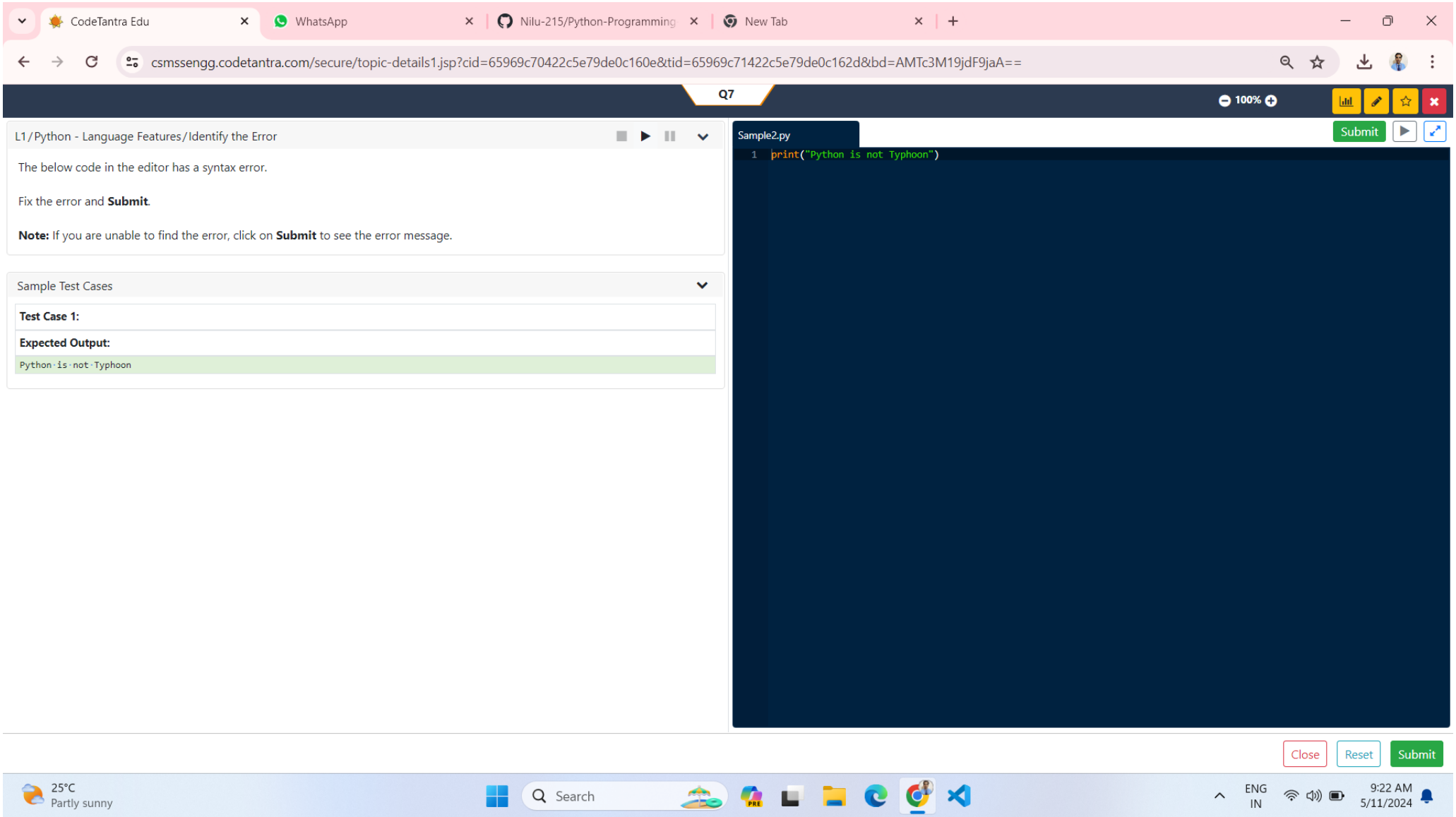
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L1/Python - Language Features/Identify the Error
The below code in the editor has a syntax error.
Fix the error and Submit.
Note: If you are unable to find the error, click on Submit to see the error message.
Sample Test Cases
Test Case 1:
Expected Output:
Python is not Typhoon
Sample2.py
Submit
1 print("Python is not Typhoon")
Close
Reset
Submit
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L1/Python - Language Features/Other usages of print function

Here are a few interesting ways in which the **print()** function works.

1. **With comma (,) as a separator:** When two or more strings are given as parameters to a **print(...)** function with a comma (,) as a separator, the strings are appended with a space and printed.
   For example:
   ```
   print("I", "Love", "Python")
   ```
   will generate the output as
   ```
   I Love Python
   ```
2. **With space as a separator:** When two or more strings are given as parameters to a **print(...)** function with space as a separator, the strings are appended **without a space** between them.
   For example:
   ```
   print("I"   "Love"   "Python")
   ```
   will generate the output as
   ```
   ILovePython
   ```
3. **With repeat character (*) :** We can print a string n times by using the repeat character (*) as shown below:
   ```
   print("ABC" * 3);
   ```
   will generate the output as
   ```
   ABCABCABC
   ```

Write code to print the magic word **Abracadabra**, n times, using the repeat character (*).

In the given code, we are taking input from the user. We will learn more about input statements in the upcoming lessons.

Sample Test Cases

Sample2.py

Submit

```
1 n = int(input())
2 print("Abracadabra" *n);
```

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L1/Python - Language Features/Fill in the missing code

The **print** statement in the below code is supposed to generate the following output:

```
where there is a will, there is a way
```

Click on **Submit** to see the current output and add or remove commas (,) accordingly to achieve the desired output.

Sample Test Cases

Test Case 1:
Expected Output:
where there is a will, there is a way

Sample3.py

Submit

```
1 print("where there is a will, there is a way")
```

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L1/Python - Language Features/Features of Python

Features of Python Programming Language

- **Simple**: **Python** is a simple and minimalistic language. Reading a good **Python** program feels almost like reading English, although very strict English! This pseudocode nature of **Python** is one of its greatest strengths. It allows one to concentrate on the solution to the problem rather than the language itself.
- **Easy to Learn**: **Python** has a very simple syntax, which means it is very easy to learn and code.
- **Free and Open Source**: Most Linux operating systems have **Python** by default. The standard modules and the **Python** interpreter are free.
- **High-level Language**: When one writes programs in **Python**, one need not bother about the low-level details such as managing the memory (allocation & deallocation) as the language has a built-in garbage collector.
- **Interpreted**: Meaning, a **Python** program need not be compiled like programs in C and Java languages, **Python** programs can be directly executed from their source code using a **Python** interpreter.
- **Portable**: **Python** interpreter exists for almost all platforms/operating systems. **Python** programs can execute on any platform like Windows, Linux, etc., without requiring any change, as long as there is a **Python** interpreter. Internally, **Python** interpreter converts the source code into an intermediate form called **byte code**, translates this into the native language of the computer, and then runs it. This is what makes a **Python** program **portable**. A **Python** program copied to another operating system works because of the **Python** interpreter present on that operating system.
- **Object Oriented**: **Python** supports procedure-oriented programming as well as object-oriented programming.
- **Extensible**: If one needs a critical piece of code or an algorithm to run very fast, one can code that part of the program in **C** or **C++** and then use or execute it from inside a **Python** program.
- **Embeddable** : Similarly, one can embed **Python** within a **C** or **C++** program.
- **Extensive Libraries**: The **Python** *Standard Library* is a very exhaustive library for regular expressions, documentation generation, unit testing, threading, databases, web browsers, CGI, FTP, Email, XML(Extensible Markup Language), XML-RPC, HTML, WAV files, cryptography, GUI (graphical user interfaces), and other OS-related operations.

Select all the correct statements from the given points.

- [x] **Python** is an interpreted language.
- [x] A **Python** program can execute **C** and **C++** programs also.
- [ ] Sending an email is not possible by using Python.
- [x] A **Python** program written on Windows operating system will also execute on Linux operating system as it is portable.

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