Python in Latex?

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What is Python?

- Python is a high-level, object-oriented programming language
- Python features an easy-to-learn syntax, making it accessible to beginners and experienced programmers.
- It offers seamless integration with other languages, allowing developers to use existing codebases written in other languages such as Java or C++
- Python is known for providing a wide range of built-in functions and modules for various tasks such as text processing, web development, and data analysis.

Listing 1: Python Example

```
list = ["Welcome,","this","is", "a", "list"]
string = "This␣creates␣a␣new␣string"
for i in range(100):
 print("Hello,␣Class␣of␣CSCI318!")
def example(string):
 print(string)

example("Here␣is␣an␣example␣of␣a␣function")
```

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What is PythonTeX?

- PythonTeX is a LaTeX package that enables the execution of Python code within LaTeX documents.
- It supports a wide range of programming languages, including Python, JavaScript, Octave, etc.
- PythonTeX is fully open source and free to use for the public
- For detailed documentation and further information, users can refer to the official PythonTeX repository on GitHub: "https://github.com/gpoore/pythontex".

Why should you use PythonTeX?

- Python can make even the hardest math problems easier.
- Using Python you can even repeat latex code.
- It can even automate document generation.
- Python easily solves issues Latex would not be able to solve.

Example

You are given a problem that says to find the number of prime numbers from a certain range, Let's say 1 to X. How would you tackle this problem?

- First, you would try to store the value of X.
- Need a way to check each number to determine if it is a prime
- Finally figure out what numbers are prime.

Is this possible with latex?

Solution

Listing 2: Finding the Prime Numbers

```
def is_prime(k):
    """Check if a number is prime"""
    if k <= 1:
        return False
    elif k <= 3:
        return True
    elif k % 2 == 0 or k % 3 == 0:
        return False
    i = 5
    while i * i <= k:
        if k % i == 0 or k % (i + 2) == 0:
            return False
        i += 6
    return True

def getPrime(x):
    """Print all prime numbers up to x"""
    print("Prime numbers from 1 to", x, "are:")
    for i in range(1, x + 1):
        if is_prime(i):
            print(i, end=" ")
```

PythonTex makes our life so much simpler allowing us to do massive calculations within the Latex software

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How to Implement Python into Latex

When you are implementing PythonTeX you need to give the package name and a special parameter that allows you to embed Python code directly within a LaTeX document.

```
\documentclass{article}
\usepackage{pythontex}
\begin{document}
\begin{pycode}
x = 100
for i in range (x):
 print("Hello,␣World!")
\end{pycode}
\end{document}
```

Explanation of how PythonTeX is Used

This calls the package PythonTeX allowing latex to utilize python

```
\usepackage{pythontex}
```

This part of the code allows latex to know where to find your python code

```
\begin{pycode}
# Here would be where your Python code will be
   implemented
\end{pycode}
```

Allows us to use the python within Latex

```
\py{ % Here you would call functions/variables}
```

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How to solve the Example

```
\begin{pycode}
def is_prime(k):
    """Check if a number is prime"""
    if k <= 1:
        return False
    elif k <= 3:
        return True
    elif k % 2 == 0 or k % 3 == 0:
        return False
    i = 5
    while i * i <= k:
        if k % i == 0 or k % (i + 2) == 0:
            return False
        i += 6
    return True

def getPrime(x):
    """Print all prime numbers up to x"""
    print("Prime␣numbers␣from␣1␣to", x, "are:")
    for i in range(1, x + 1):
        if is_prime(i):
            print(i, end="␣")
\end{pycode}
\py{getPrime(1000)}
```

Did it work?

Prime numbers from 1 to 1000 are: 2 3 5 7 11 13 17 19 23 29 31 37 41 43 47 53 59 61 67 71 73 79 83 89 97 101 103 107 109 113 127 131 137 139 149 151 157 163 167 173 179 181 191 193 197 199 211 223 227 229 233 239 241 251 257 263 269 271 277 281 283 293 307 311 313 317 331 337 347 349 353 359 367 373 379 383 389 397 401 409 419 421 431 433 439 443 449 457 461 463 467 479 487 491 499 503 509 521 523 541 547 557 563 569 571 577 587 593 599 601 607 613 617 619 631 641 643 647 653 659 661 673 677 683 691 701 709 719 727 733 739 743 751 757 761 769 773 787 797 809 811 821 823 827 829 839 853 857 859 863 877 881 883 887 907 911 919 929 937 941 947 953 967 971 977 983 991 997 None