Type Annotations in Python

Terribly Intimidating or Tremendously Informative?

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def start(t: Talk) -> List[Fun, Learn]:
Okay, what is this about?

Key Questions

What are the **benefits** and **challenges** associated with using type annotations inside of Python program? Will types make me a better programmer?

Intended Audience

An **adventuresome** Python programmer who wants to explore how both a new **paradigm** and software **tools** can improve their development skills!

Let's explore type annotations in Python programs!
def extract_urls(df):
    """Extract a list of urls."""
    urls = []
    if "Url" in df.columns:
        urlc = df["Url"]
        if urlc is not None:
            urls = urlc.tolist()
    return urls

What is the type of df? The terrible docstring does not say!

What is the behavior of return urls in this function?
def extract_urls(df):
    """Extract a list of urls.""
    urls = []
    if "Url" in df.columns:
        urlc = df["Url"]
        if urlc is not None:
            urls = urlc.tolist()
    return urls

What happens if the program becomes more complex?
```python
def extract_urls(df: pandas.DataFrame) -> List[str]:
    """Extract a list of urls.""
    urls = []
    if "Url" in df.columns:
        urlc = df["Url"]
        if urlc is not None:
            urls = urlc.tolist()
    return urls
```

What is the purpose of `df: pandas.DataFrame`?
Wait, isn't this more complicated?

Do type annotations have any benefits?

What are the trade-offs of type annotations?
Challenges

- **Readability**: function signatures are more difficult to read
- **Productivity**: programmers often must add type annotations
- **Complexity**: programs use many new classes and types

Benefits

- **Fail-fast**: quickly catch errors before running Python programs
- **Tooling**: text editors signal problems to programmers
- **Understanding**: developers understand the structure of data

*Pyright* language server in VS Code and Neovim

*Mypy* static type checker in terminal or editor
Easy command-line interface with Typer

Quickly find a defect that crashes a program

AnalyzeActions/WorkKnow
Command-Line Interface with Typer

```python
import typer
cli = typer.Typer()
@cli.command()
def download(
    repo_urls: List[str],
    repos_csv_file: Path = typer.Option(None),
    results_dir: Path = typer.Option(None),
    env_file: Path = typer.Option(None),
):

    See AnalyzeActions/WorkKnow for details!
```
Command-Line Interface

Usage: workknow download [OPTIONS] REPO_URLS...
   Download the GitHub Action workflow history of repositories.
Arguments:
   REPO_URLS...  [required]
Options:
   --repos-csv-file PATH
   --results-dir PATH
   --env-file PATH
   --peek / --no-peek    [default: False]
   --save / --no-save    [default: False]
   --debug-level [DEBUG|INFO|WARNING|ERROR|CRITICAL]  [default: ERROR]
   --help               Show this message and exit.

- Using type annotations, Typer can:
  - automatically generate all menus
  - perform error checking on all arguments
  - convert all arguments to the correct type
```python
def create_results_zip_file(
    results_dir: Path, results_files: List[str]
) -> None:
    """Make a .zip file of all results.""
    with zipfile.ZipFile(
        "results/All-WorkKnow-Results.zip",
        "w",
    ) as results_zip_file:
        for results_file in results_files:
            results_zip_file.write(results_files)
```
Pyright Feedback in VS Code

Argument of type "List[\text{str}]" cannot be assigned to parameter "filename" of type "StrPath" in function "write"

```
with zipfile.ZipFile(
    "results/All-WorkKnow-Results.zip",
    "w",
) as results_zip_file:
    for results_file in results_files:
        results_zip_file.write(results_files)
```
Type Annotations in Python

Terribly Intimidating or Tremendously Informative?

- Programmers define types
- Automatically create command-line
- Type checkers automatically find bugs
Type Annotations in Python

Yes, they are Tremendously Informative! Try them!

AnalyzeActions/WorkKnow

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