CPSC 103

Introduction to Systematic Program Design

2021S

Lecture: Module 5 – Arbitrary-Sized (Part 1)

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25 May, 2021

Announcements

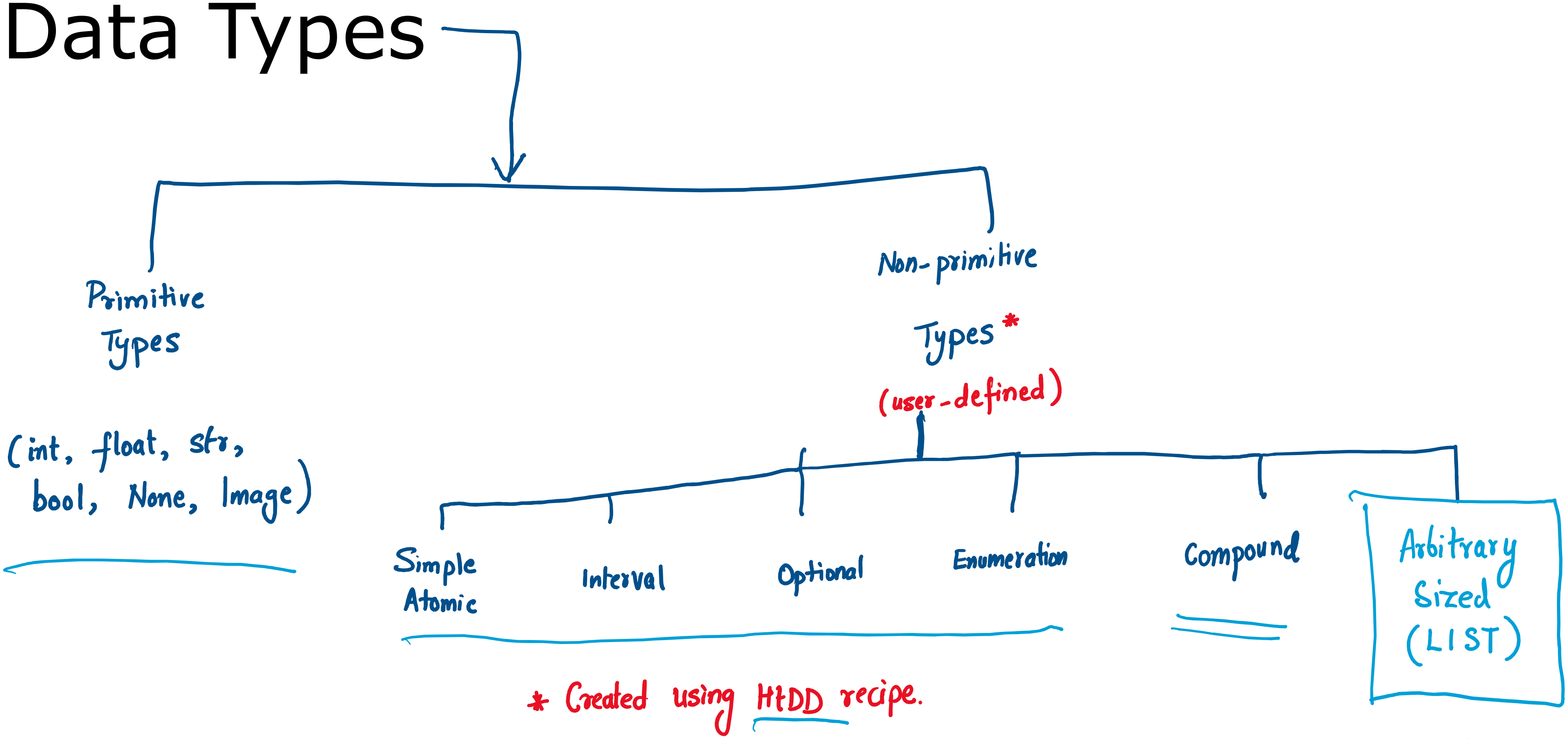
1. Project
    1. Project Proposal Deadline on 31 May, 10pm PDT.
2. Midterm
    1. Date: Fri May 28, 7pm PDT
    2. Everything covered until today will be on midterm
    3. Midterm Review session by TAs (Wed 4-5pm)
    4. “Important Information about Midterm” posted on Piazza. ✓
    5. ✓ Exam Piazza for midterm: piazza.com/ubc.ca/summer2021/cpsc103911exam/home
    6. ✓ Test Zoom room will be available on Thursday May 27th. (Wed)
3. This week Tutorial 5 for both days. You will submit it together on June 2, 10pm PDT.
4. Module 7 open for pre-class readings. 1

Recap

1. Design Data Definitions for Non-Primitive Data Types (using HtDD)
    1. Compound (e.g., Book, Song, Game)
2. How to Design functions which operate on non-primitive data types
    1. Whether a given book published in 2021? ✓
    2. Which is a longer song of the given two? ✓
    3. Can we play a game with given number of players?

Recap

Data Types



* Created using HtDD recipe.

Recap

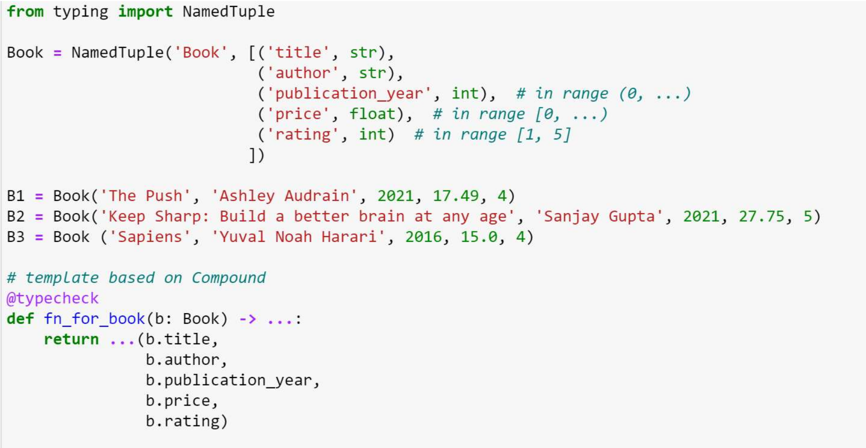
How to Design Data

(HtDD) Recipe

HtDD recipe is about designing data definitions of user-defined types.

HtDD recipe consists of the following steps:

1. A **data type definition** with type comments where Python's types are not specific enough.
2. An **interpretation comment** that describes the correspondence between information and data.
3. One or more **examples** of the data.
4. A **template** for a one-argument function operating on data of this type.



```python
from typing import NamedTuple

Book = NamedTuple('Book', [('title', str),
                           ('author', str),
                           ('publication_year', int),  # in range (0, ...)
                           ('price', float),  # in range [0, ...)
                           ('rating', int)  # in range [1, 5]
                          ])

B1 = Book('The Push', 'Ashley Audrain', 2021, 17.49, 4)
B2 = Book('Keep Sharp: Build a better brain at any age', 'Sanjay Gupta', 2021, 27.75, 5)
B3 = Book ('Sapiens', 'Yuval Noah Harari', 2016, 15.0, 4)

# template based on Compound
@typecheck
def fn_for_book(b: Book) -> ...:
    return ...(b.title,
               b.author,
               b.publication_year,
               b.price,
               b.rating)
```

Learning Goals

1. Arbitrary Sized Data
    1. Identify Problem Domain Information of arbitrary size that should be represented as Python’s List type.
2. Design Data definitions for List of Primitive types
    1. Use HtDD and Data Driven Templates with arbitrary-sized data.
3. Understanding Concepts
    1. For Loops ✓
    2. Accumulator ✓
    3. For loop execution ✓
4. Design Functions that take in and/or return lists. ✓

What is arbitrary-sized?

Examples

In real life scenario, we don’t deal with one data item;
we deal with collection of data, which is of arbitrary size.
We represent this collection of data as arbitrary-sized or List.

PRIMITIVE

List[int] [1, 2, 3, 4, 5]

List[str] ["UBC", "UVIC", "SFU"]

List[bool] [True, False, True, True]

List[float] [1.25, -1.5, 0.039]

NON-PRIMITIVE

List[Book] = [Book('', '', '' ..),
Book('...', '...'),
:
]

✓ List[Song]

✓ List[Game]

What is arbitrary-sized?

Important Points

1. A list is always specified by [ ] ✓
2. The items of a list are separated by comma, except last item which has no comma after it. ✓
3. Length of a list is total number of items in the list.
4. Every item has a position in the list which starts from 0 to length – 1.
5. Python helps you to move through the list using For-loops.
6. *Fun fact:* A string is a special type of a list.

name = "Ashish"

String which is also a list for python, that's why name[0] works!

Scores = [1, 2, 3, 4, 5, 6] => Length of scores = 6

0 1 2 3 4 5 ← POSITIONS

Scores[3]

=> 4

Scores[0]

1

Scores[6]

ERROR

For loop

A for loop enables a particular set of commands to be executed repeatedly for all elements in a list.

container to carry current item

For s in los :

print(s + " is good!")

los = ['UVIC", 'SFU', 'UBC']

	s	los
Pass 1 :	"UVIC"	['UVIC', 'SFU', 'UBC']
pass 2 :	"SFU"	["UVIC", 'SFU', 'UBC']
pass 3 :	"UBC"	['UVIC', 'SFU' 'UBC']

▨ items seen so far

Accumulator

The accumulator is a variable used to store the result of some calculation for all variable that the for loop has visited so far.

Let say you want to add a list of numbers.

```
acc = 0          # type: int
For i in loi        :
        acc = acc + i
```

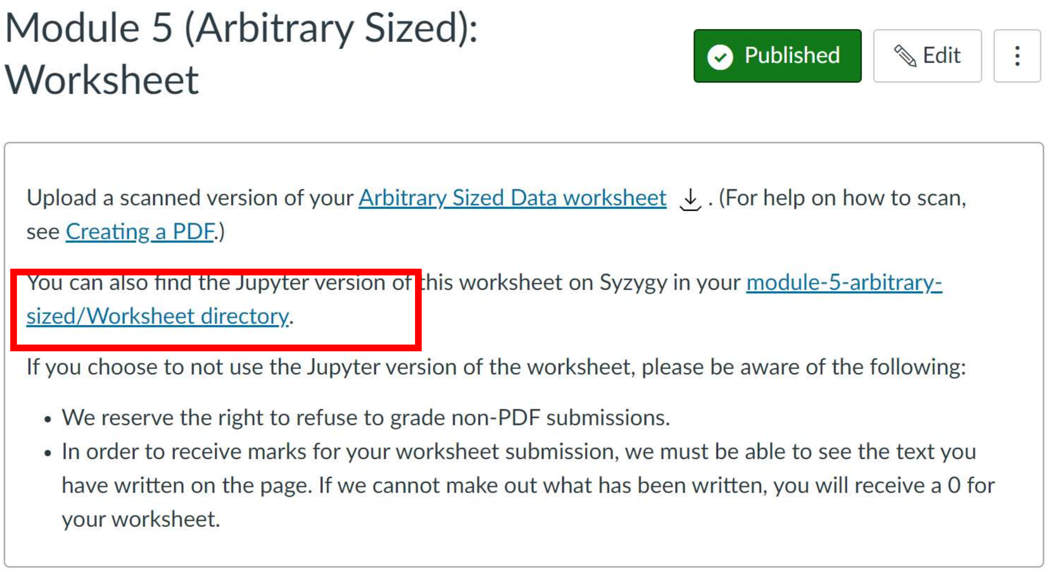
accumulates the result of intermediate execution of for-loops.

loi = [1, 5, 8, 3]

	acc	i	loi
pass 1 :	0	1	[1, 5, 8, 3]
pass 2 :	1	5	[1, 5, 8, 3]
pass 3 :	6	8	[1, 5, 8, 3]
pass 4 :	14	3	[1, 5, 8, 3]
pass 5 :	17	X	[1, 5, 8, 3]

Worksheet Activity Time!

Let’s do
Question 1 - 6



Module 5 (Arbitrary Sized): Worksheet

Upload a scanned version of your Arbitrary Sized Data worksheet . (For help on how to scan, see Creating a PDF.)

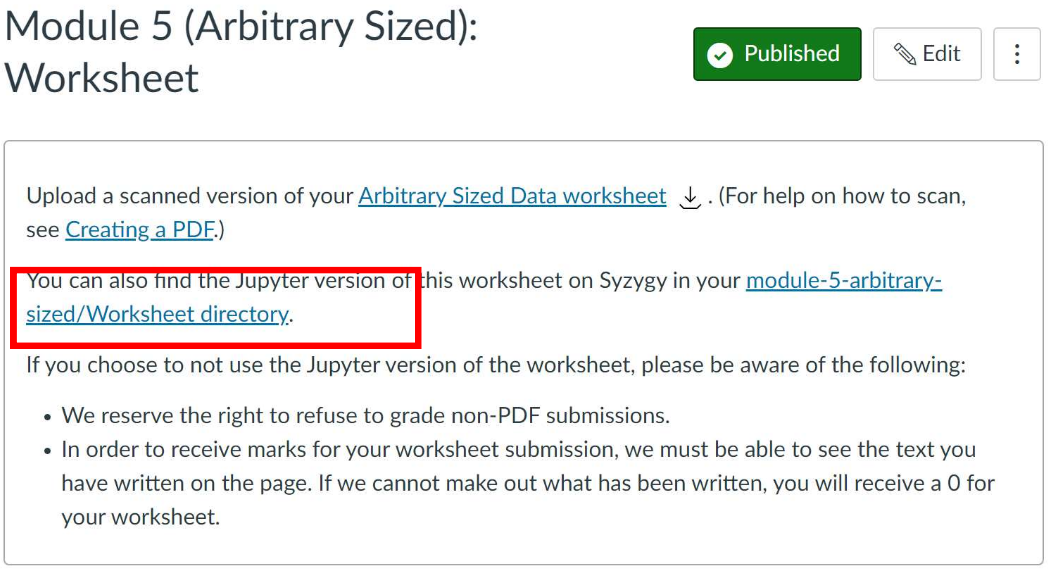
You can also find the Jupyter version of this worksheet on Syzygy in your module-5-arbitrary-sized/Worksheet directory.

If you choose to not use the Jupyter version of the worksheet, please be aware of the following:

- We reserve the right to refuse to grade non-PDF submissions.
- In order to receive marks for your worksheet submission, we must be able to see the text you have written on the page. If we cannot make out what has been written, you will receive a 0 for your worksheet.

Worksheet Activity Time!

Let’s do
Question 7 - 10



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