CPSC 103

Introduction to Systematic Program Design

2021S

Lecture: Module 4 - Compound

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20 May, 2021

Announcements

1. Syllabus Quiz due Tomorrow.

2. Tutorial Resubmission is open.

3. Project
   1. If you are re-taking this course, you cannot use the same project you submitted before.
      It is considered as Academic Misconduct.

4. Midterm
   1. Date: Fri May 28, 7pm PDT
   2. Extra office hours next week to support midterm preparation (will be announced on Piazza)
   3. Midterm Review session by TAs (to be announced on Piazza)
   4. I will be posting a detailed post about FAQ related to Midterm by this weekend.
   5. "Sample Exams" module will be available on Canvas by tomorrow

5. Module 5 and Module 6 open for pre-class readings.

Recap

1. Design Data Definitions for <u>Non-Primitive Data Types</u> (using HtDD)
   1. Simple Atomic   (e.g., CountryName)
   2. Interval   (e.g., Temperature)
   3. Optional   (e.g., CountdownTimer, SensorReading)
   4. Enumeration   (e.g., Grade, TrafficLight)

2. How to <u>Design functions</u> which operate on non-primitive data types
   1. Robotic Wheelchair Problem
   2. Next Traffic Light Problem

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)
```
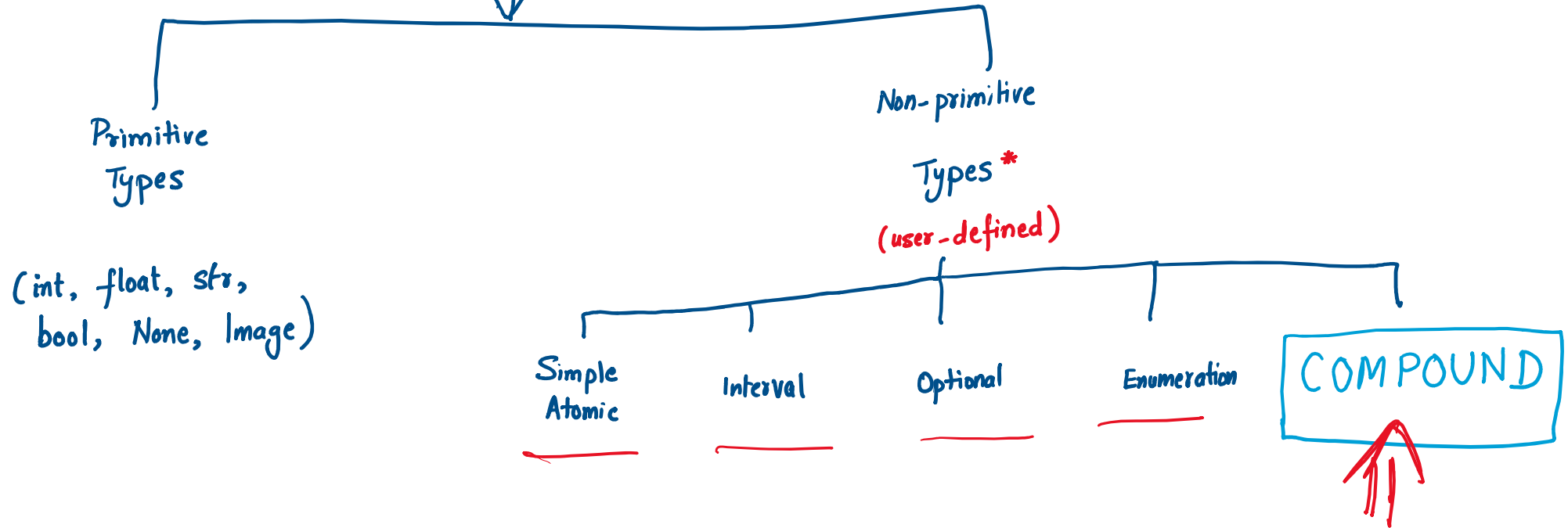
Learning Goals

1. Compound Data
   1. Identify Problem Domain Information that should be represented as compound data.

2. Design Data definitions for Compound
   1. Understand and write NamedTuple definitions.
   2. Use HtDD and Data Driven Templates with compound data.

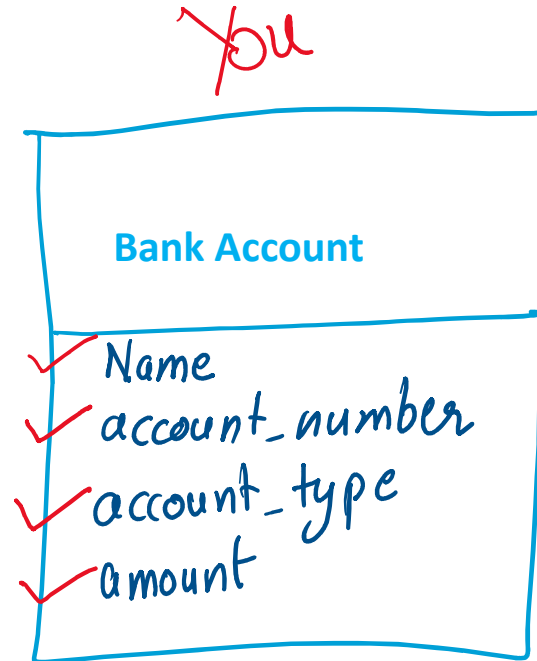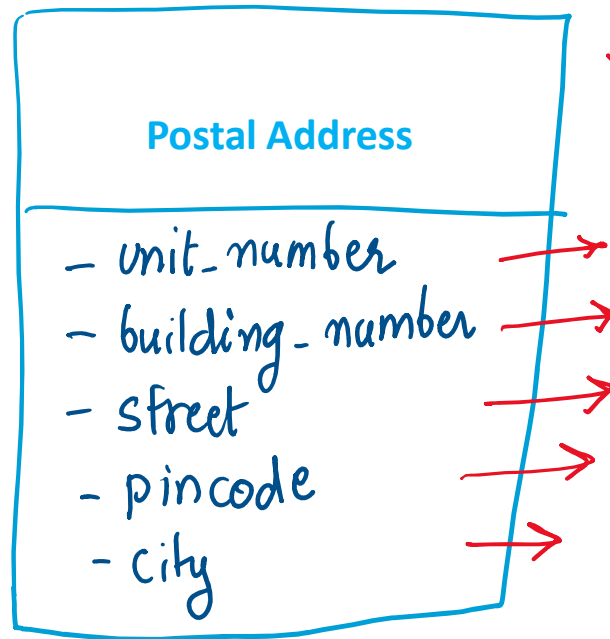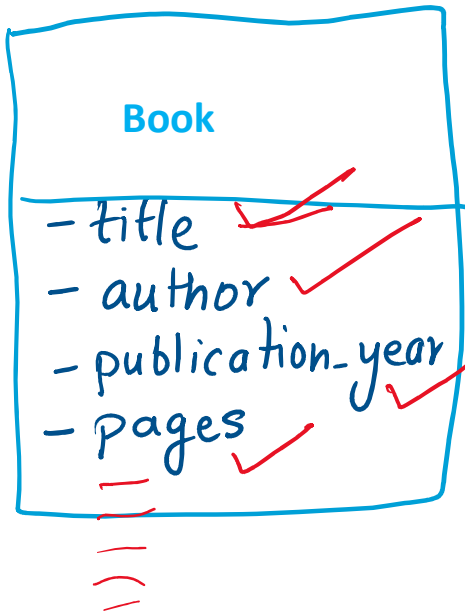3. Design Functions that take in and/or return compound data.

Data Types

Primitive
Types

(int, float, str,
bool, None, Image)

Non-primitive

Types *

(user-defined)

Simple
Atomic

Interval

Optional

Enumeration

COMPOUND

* Created using HtDD recipe. ✓

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Compound

Examples

Book
- title
- author
- publication_year
- pages

Postal Address
- unit_number
- building_number
- street
- pincode
- city

Bank Account
- Name
- account_number
- account_type
- amount

You

Song
- title
- album
- singer
- duration

Rest on Jupyter Notebook at:

Module4-compound > Lecture > Ashish > Lecture Python Notebook – Module 4 (Compound) – Blank.ipynb

Worksheet Activity Time!

Let's do
Question 1, 3, 4, 5

Module 4 (Compound): Worksheet ✓ Published ✎ Edit ⋮

Upload a scanned version of your Compound 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-4-compound/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.

Assert Statements

For information which has a range, we specify it via comments., but how can we make sure
that someone will not provide value outside the range?

① In the fn that takes a Song, we will check:

$$\text{assert duration} > 0$$

② In can_we_play() function, we will check if
min_players and max_players are in range using
assert.

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Worksheet Activity Time!

Let's do
Question 2, 6, 7, 8

Module 4 (Compound): Worksheet   ✓ Published   ✎ Edit   ⋮

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