CPSC 103

Introduction to Systematic Program Design

2021S

Lecture: Module 3 - How to Design Data

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18 May, 2021

Announcements

1. No Communication through Canvas.
2. “Midterm Accommodation Request” survey posted on Piazza.
3. Project Module Released on Canvas.
    1. Project Proposal due on May 31, 10 pm PDT
    2. Project TA mentors will be assigned. ✓
    3. Late Policy is applied to Milestone and Final Submission only.
4. Syllabus Quiz due on Fri. May 21 10pm PDT.
5. Module 5 and Module 6 open for pre-class readings, due May 24th 10 pm.
    1. Module 5 has 2 readings, 2 Pre-lecture Assignments;
    2. Module 6 has 1 reading and 1 Pre-lecture Assignment;

} 3

Recap

1. Primitive Data Types
    1. int (1, -4, 98)
    2. float (0.123, 1.8863, -9.73)
    3. str ("British Columbia", "CPSC103")
    4. bool (True, False)
    5. None (None)
    6. Image
2. How to Design functions which operate on primitive data types, using HtDF recipe

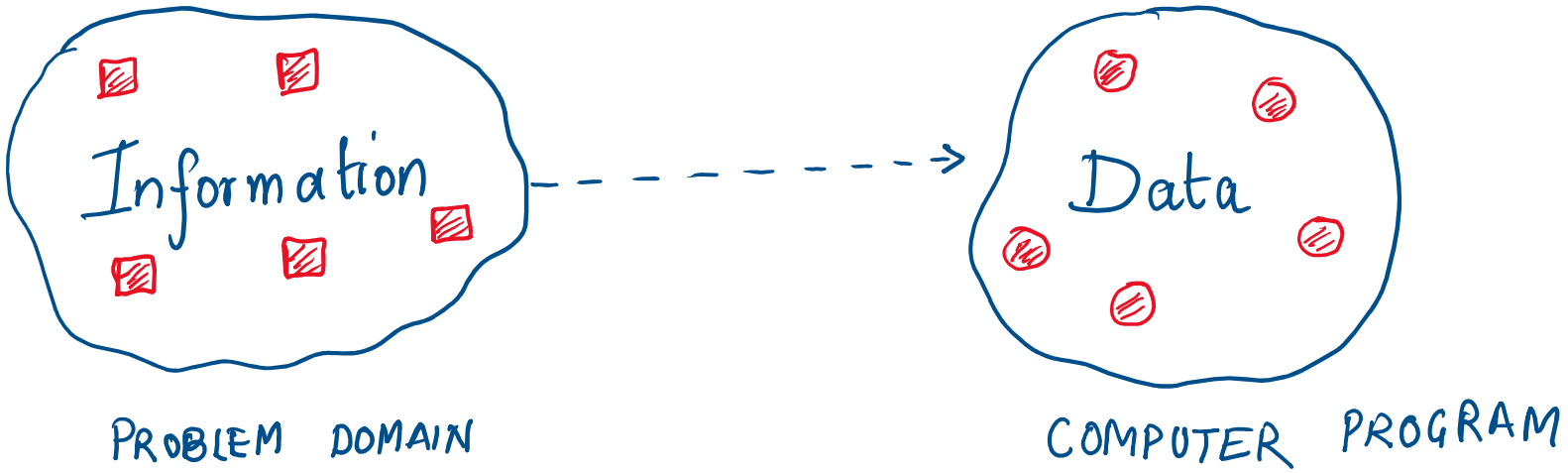
Learning Goals

1. What are non-primitive (or User-defined) data types
    1. Identify Problem Domain Information that should be represented as simple atomic data, intervals, enumerations, and optionals.
2. How to represent these types using HtDD recipe in your program.
    1. Use How to Design Data Definitions (HtDD) recipe to design Data Definitions.
    2. Use Data Driven Template recipe to generate templates for functions operating on data of a user-defined type.
3. Use HtDF recipe to design functions operating on data of user-defined types.

primitive

Information to Data Representation

When we try to solve a problem using computing, we first identify the information in the problem domain as represent it as data in our programs.



Examples

Double

Design a program that returns the double of a given number.

int / float

CPSC 103 d-tective!

Design a function that determines if a string starts with letter d.

str

inputs / outputs

Make Circle

Design a function that makes a solid circle of given radius and color

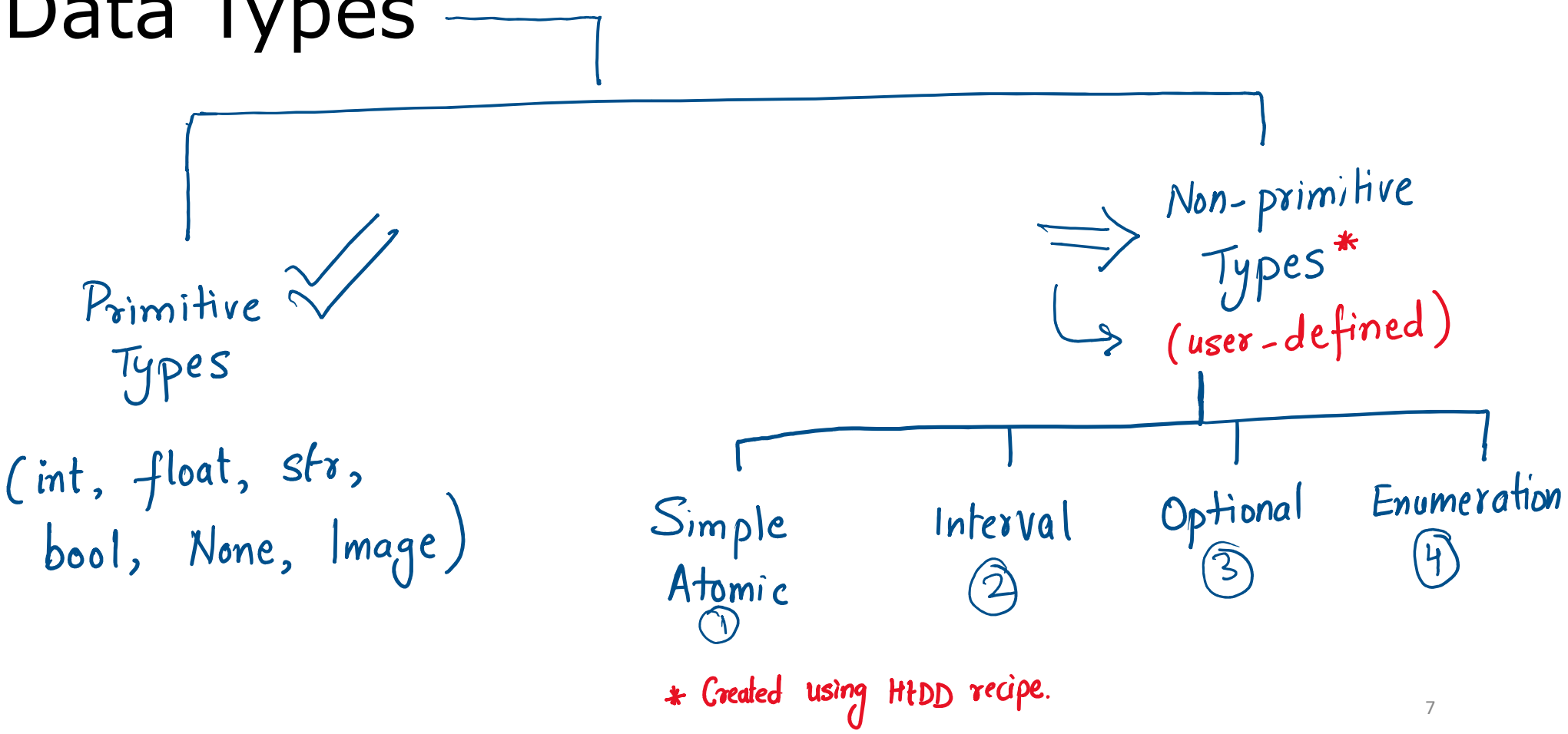
Image float str

Declaring Result

Design a function that returns the "Pass" or "Fail" rating based on student's score in the class.

str → int / float

Data Types


Primitive Types
(int, float, str, bool, None, Image)
Non-primitive Types*
(user-defined)
Simple Atomic
1
Interval
2
Optional
3
Enumeration
4
* Created using HtDD recipe.

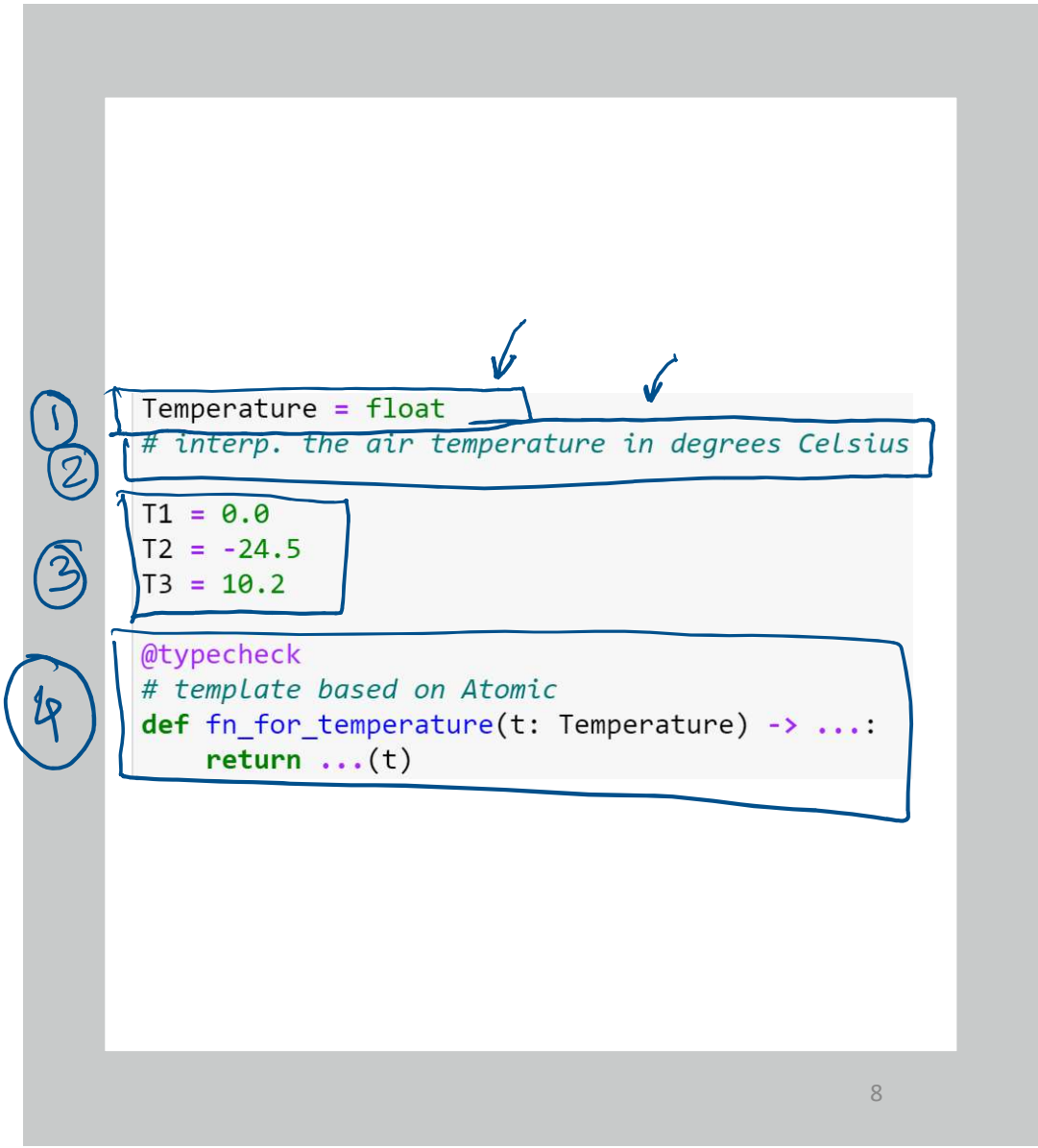
Designing user-defined data types

How to Design Data
(HtDD) Recipe

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

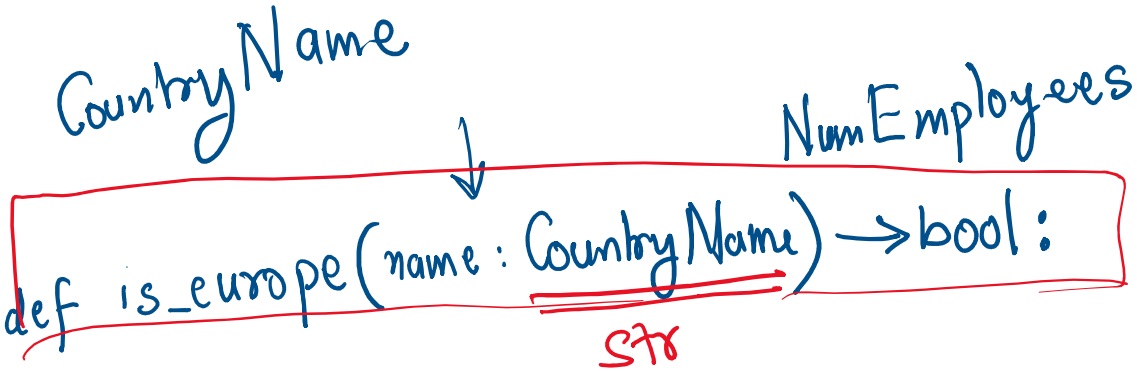
HtDD recipe consists of the following steps:

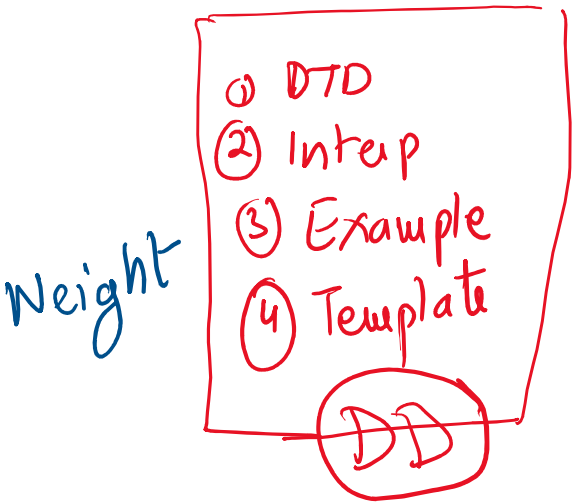
1. A **data type definition** with type comments where Python's types are not specific enough.
2. An **interpretation comment** that describes the correspondence between information and data.
3. One or more **examples** of the data.
4. A **template** for a one-argument function operating on data of this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



1. Simple Atomic

When the information to be represented is itself **atomic in form**.
Tip: Usually these are just the primitive data with a **better name** and **description**.





The name of a country

Number of Employees in a company

The weight of an animal in Zoo

2. Interval

When the information to be represented is **numbers** within a **certain range**.

Temperature = float # in range [0, 250]

[0, ...)

[0,100] = 0, 100 include

(0,100] = 0 not included
100 included

The temperature of an oven from 0 deg. Celsius to 250 deg. celcius

A student's grade in a class in percentage.

0 — 100

Grade = float # in range [0, 100]

3. Optional

When the information to be represented is well-represented by another form of data (often simple atomic or interval) **except** for **one special case**.

GPA of a student at UBC.

Reading of a Countdown Timer. It is off or 10 to 0.

3. Enumeration

When the information to be represented consists of a
fixed number of distinct values

The Book genre one of fiction, fantasy, drama, history, science.

The light of a traffic signal as one of Red, Green, Yellow.

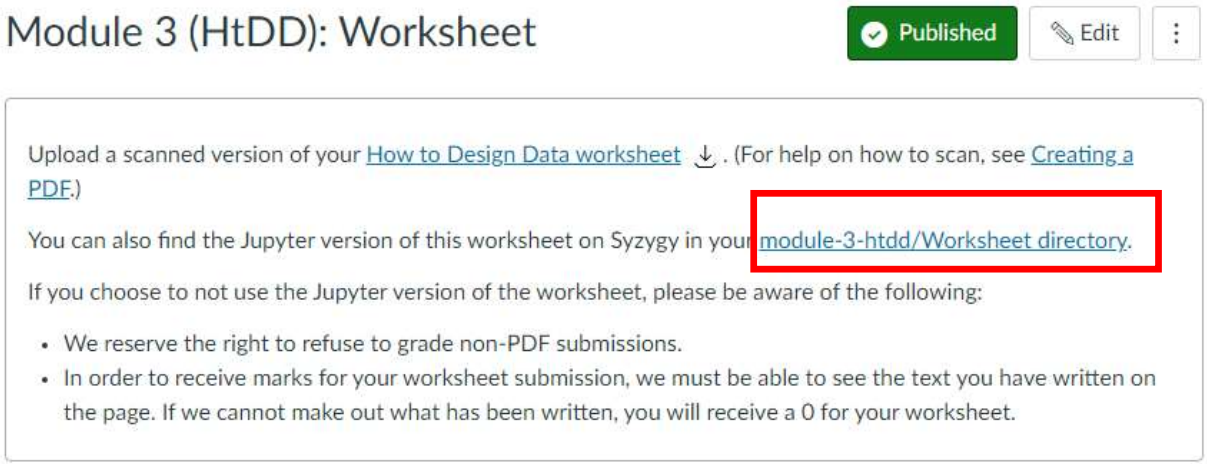
Grades given to a student as one of A, B, C, D, F

Rest on Jupyter Notebook at:

Module3-htdd > Lecture > Ashish > Lecture Python Notebook – Module 3 (HtDD) – Blank.ipynb

Worksheet Activity Time!

Let's do
Question 1 – 3



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Worksheet Activity Time!

Let's do
Questions 4, 5, 7, 8