

## Computer Science 136

### Data Structures

#### Lecture #4 (September 17, 2021)

1. Reminder: Finish up lab by Tuesday, 5pm.
2. The focus of the course: *abstract data types* (ADT's)
  - (a) An encapsulation of *state* with controlled access.
  - (b) Part 1: A public *interface* that describes how the ADT's state might be manipulated using carefully specified methods. These methods *abstract away* the unimportant details.
  - (c) Part 2: A protected *implementation* that hides the *actual mechanism* used to maintain the state.
  - (d) Between method calls, the ADT is in a consistent, valid state.
  - (e) Objects are the most common method of supporting the ADT.
3. A recipe scaling program.
  - (a) Makes use of the `structure` package; imports `structure.Association` and `structure.Assert`.
    - i. `Associations` are key-value pairs. Keys cannot be changed, but values they're associated with can.
    - ii. `Assert` provides methods that test program conditions you believe to be true. If a condition is not true, the program halts with information about the point of failure.
  - (b) Makes use of an example, `Ratio`, for keeping track of fractional values.
    - i. Ratios have a numerator and denominator, which cannot be changed.
    - ii. They have accessor methods (e.g. `getNumerator` and `getDenominator`).
    - iii. They have private utility methods (e.g. `gcd`, the greatest common divisor).
    - iv. They have public utility methods (e.g. `add`, `product`, etc.) as well as a `toString` method.
  - (c) We develop a new class, to hold a recipe:
    - i. Has a title, serving count, a list of ingredients, and instructions.
    - ii. Title never changes.
    - iii. Serving count can be changed to rescale the recipe.
    - iv. Ingredients are added incrementally.
      - A. Kept in an array, with a count.
      - B. Has a maximum number of ingredients (20) as an upper bound. Can be changed at compile time.
    - v. Instructions are appended as they're added.

## Notes & Recipes:

### Duane's Orange Chocolate Chip Muffins (serves 12)

1/2 C butter  
1/2 C sugar  
1/2 C brown sugar  
2 large eggs  
2 oranges (zest only)  
1/2 C orange juice  
1/2 C plain yogurt  
1/2 t baking soda  
1 t baking powder  
2 C flour  
1 C chocolate chips  
1 T Swedish pearl sugar

Preheat oven to 375. Grease muffin cups.  
Cream butter and both sugars until fluffy.  
Beat in eggs, zest, orange juice, and yogurt.  
Fold in the flour, baking soda, and powder.  
Fold in chocolate chips.  
Scoop batter into cups, top with pearl sugar.  
Bake for 25 to 30 minutes.