Refactoring Review

Name these refactorings. If there are *two possible answers, then write the name of either* ***one*** *refactoring.*

The *Refactoring Category* is shown at the bottom.
https://refactoring.guru/refactoring/techniques

#1

BEFORE

```
def normalize(text):
  """Reformat some text"""
  text = text.trim()
  text =
     text.replace('_', ' ')
  return text
```

AFTER

```
def normalize(text):
  """Reformat some text"""
  result = text.trim()
  result =
    result.replace('_',' ')
  return result
```

Refactoring Category: Composing Methods

#2 (two possible answers)

BEFORE

```
def roots(a, b, c):
  """Roots of Quadratic"""
  if b*b - 4*a*c >= 0:
    x1 = (-b +
    sqrt(b*b-4*a*c))/(2*a))
    x2 = (-b -
    sqrt(b*b-4*a*c))/(2*a))
    return (x1, x2)

  return None
```

AFTER

```
def roots(a, b, c):
  """Roots of Quadratic"""
  descrim = b*b - 4*a*c
  if descrim >= 0:
    descrim = sqrt(descrim)
    x1 = (-b + descrim)/(2*a)
    x2 = (-b - descrim)/(2*a)
    return (x1, x2)

  return None
```

#3

BEFORE

```
def find(text: str):
  """Find text in file"""
  found = False
  line = None
  file = open("somefile")
  while not found:
     line = file.readline()
     if text in line:
        found = True
  file.close()
  return line
```

AFTER

```
def find(text: str):
  """Find text in file"""
  with open("somefile")
       as file:
     for line in file:
        if text in line:
           return line

  return None
```

Simplifying Conditional Expressions

(many students write code like on the left)

#4

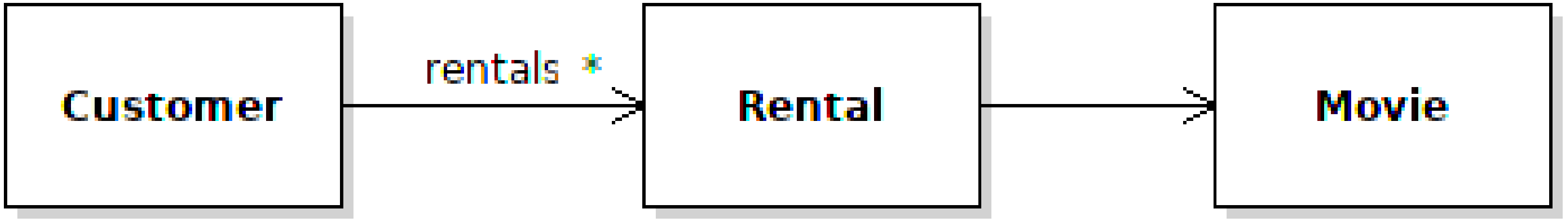
BEFORE

```
# chain calls to get title


title = rental.get_movie()\
              .get_title()
```

AFTER

```
# Rental gets title from
# movie and returns it.
# Movie also has get_title
title = rental.get_title()
```



Moving Features Between Objects

#5

BEFORE

```
first = 'Bill'
last  = 'Gates'
email = 'bill@msft.com'

print_person(
    first, last, email)

def print_person(*args):
   print(f"{args[0]}
           {args[1]}
    email <{args[2]}>")
```

AFTER

```
@dataclass
class Person:
    first: str
    last: str
    email: str
p = Person("Bill","Gates",...)
print_person(p)

def print_person(person):
   print(f"{person.first}
           {person.last}
   email <{person.email}>")
```

Simplifying Method Calls

#6

BEFORE

```
def print_rental(title,
       days_rented, price):
   print("{:20s} {:6d} {:f}"
     .format(title,
            days_rented,
            price))


# Usage:
r = Rental("Frozen", 3)
print_rental(r.get_title(),
   r.get_days_rented(),
   r.get_price())
```

AFTER

```
def print_rental(r: Rental):
   print("{:20s} {:6d} {:f}"
     .format(
        r.get_title(),
        r.get_days_rented(),
        r.get_price()))


# Usage:
r = Rental("Frozen", 3)
print_rental(r)
```

Simplifying Method Calls

#7

BEFORE

```
def vote(question, choice):
  if not question.can_vote():
    messages.error(
        "voting not allowed")
  elif choice not in
      question.choice_set():
      messages.error("invalid ...")
  else:
      Vote.objects.create(
           user=user, question=...)
      return redirect('polls:result')
  # if any error, redirect to
detail
  return
redirect('polls:detail',...
```

AFTER

```
def vote(question, choice):
  if not question.can_vote():
     messages.error(
        "voting not allowed")
     return redirect('polls:detail',..
  if choice not in \
         question.choice_set():
     messages.error("invalid ...")
     return redirect('polls:detail',..

  Vote.objects.create(
       user=user, question=...)
  return redirect('polls:result',...)
```

Simplifying Conditional Expressions

#8 (two possible answers)

BEFORE

```
def greet(name):
  if datetime.now().hour<12:
     print("Good morning",
           name)
  else:
     print("G'd afternoon",
           name)
```

AFTER

```
def greet(firstname):
  if is_morning():
     print("Good morning",
           name)
  else:
     print("G'd afternoon",
           name)

def is_morning() -> bool:
  return \
    datetime.now().hour < 12
```

1. Simplifying Conditional Expressions

2. Composing Methods

#9

BEFORE

```
game = Game(800, 600)
```

AFTER

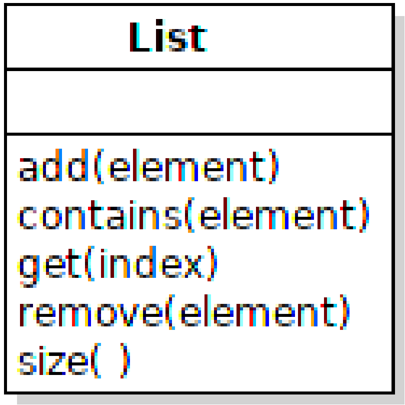
```
CANVAS_WIDTH = 800
CANVAS_HEIGHT = 600

game = Game(CANVAS_WIDTH,
            CANVAS_HEIGHT)
```

#10

BEFORE

Same code in many collections.



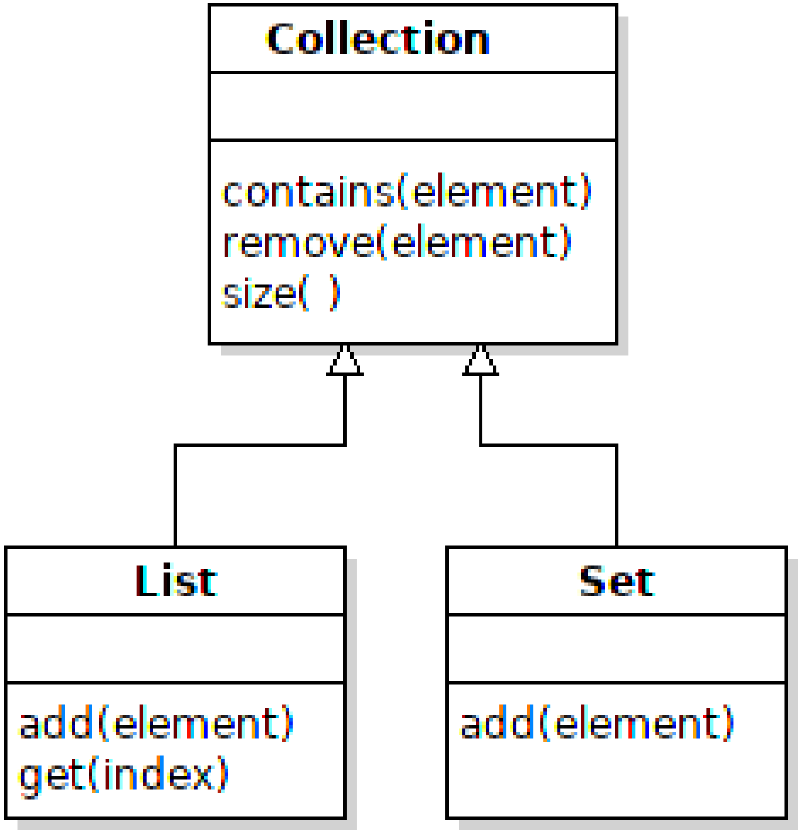
List

add(element)
contains(element)
get(index)
remove(element)
size( )

Set

add(element)
contains(element)
remove(element)
size( )

AFTER



Collection

contains(element)
remove(element)
size( )

List

add(element)
get(index)

Set

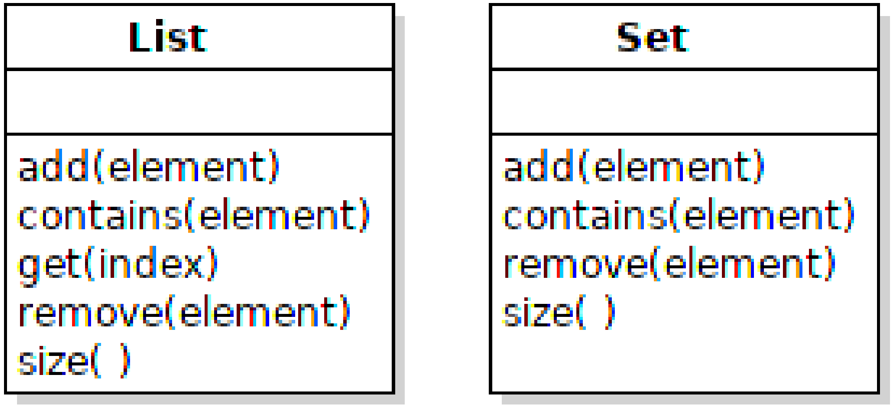
add(element)

Dealing with Generalization

#11: Why not move `add(element)` to Collection, too?

BEFORE

Same code in many collections.



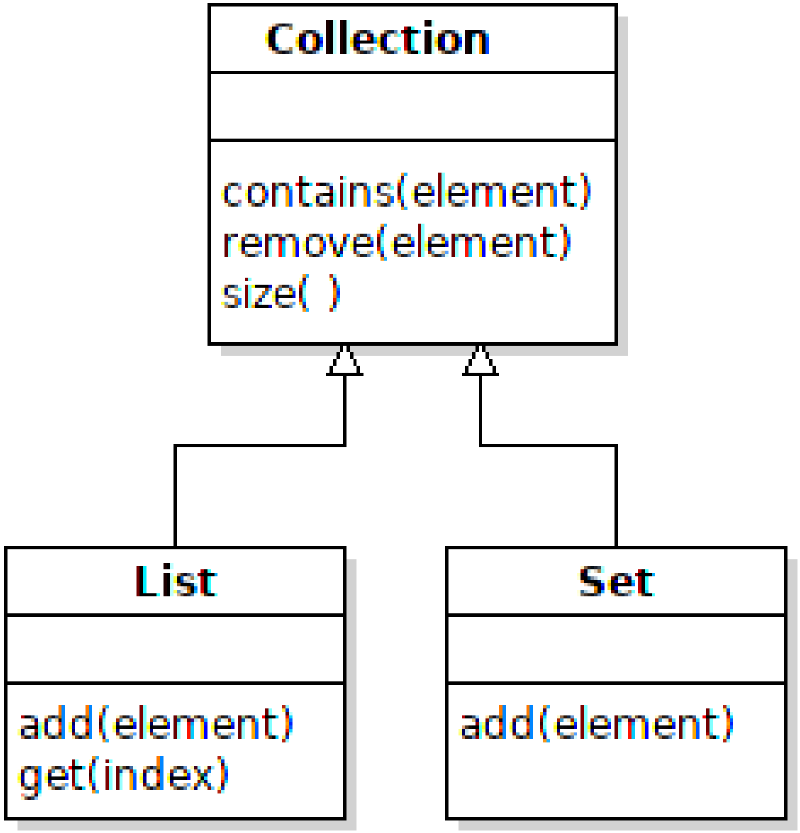
List

add(element)
contains(element)
get(index)
remove(element)
size( )

Set

add(element)
contains(element)
remove(element)
size( )

AFTER



Collection

contains(element)
remove(element)
size( )

List

add(element)
get(index)

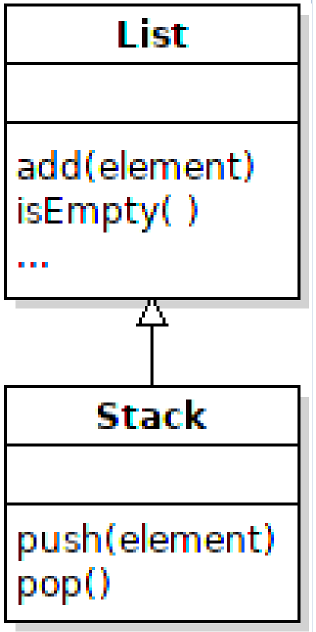
Set

add(element)

You Can't Generalize Everything

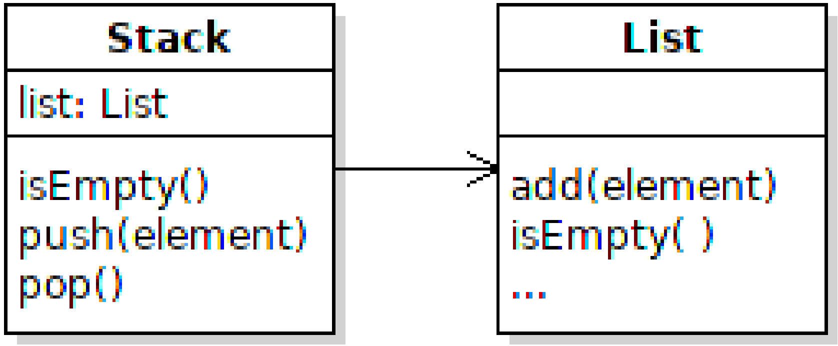
#12

BEFORE



```
class Stack(List):
  def push(self, e):
      super().append(e)
```

AFTER



```
class Stack:
  def push(self, e):
      self.list.append(e)
```

Dealing with Generalization

Why Not Stack extends List?

O-O Basics:

- A Stack *is not* a List. Fails the "*is a*" test.
- Liskov Substitution Principle - *can't substitute Stack for List*

Design Principles used:

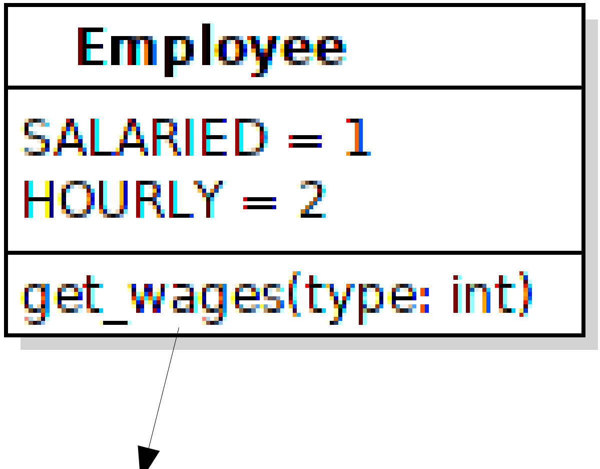
- *Prefer Composition over Inheritance*, also called
- *Prefer Delegation over Inheritance*

Code Symptom:

- ________________ - Stack doesn't use most List methods

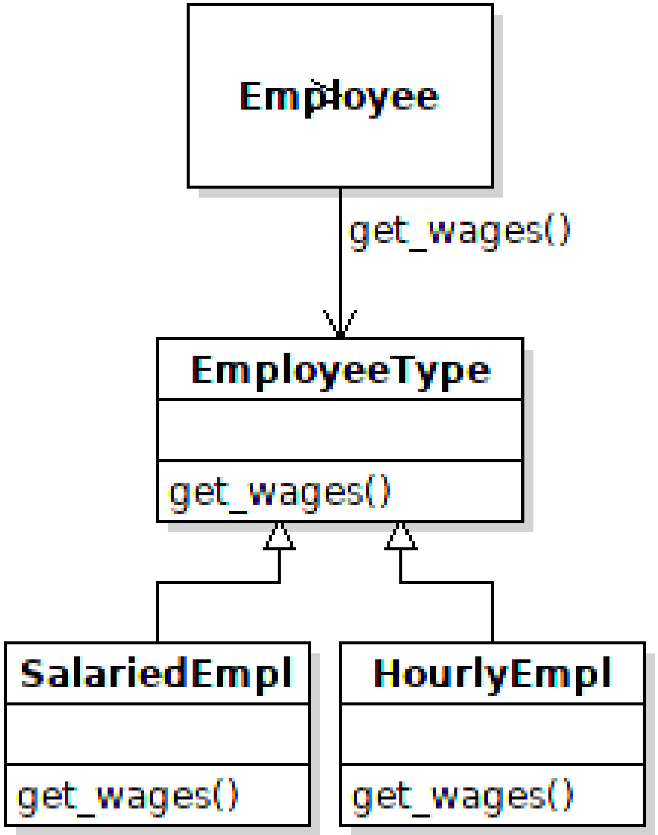
#13 (two possible answers)

BEFORE



```
def get_wages(self, type):
    if type == SALARIED:
        # return self.salary
    elif type == HOURLY:
        # return wage*hours
```

AFTER



1. Organizing Data

2. Simplifying Conditional Expressions

#14 Name Two Refactorings

BEFORE

```
class Rental:
  def get_price(self):
     if type == NEW_RELEASE:
        price = 3*self.days
     elif type == CHILDREN:
        price = 1.5 + \
        1.5*max(0, self.days-3)
     else:
        price = ...
     return price
```

AFTER

```
class Rental:
    days: int
    price_code: PriceCode

    def get_price(self):
      return self.price_code.\
         get_price(self.days)

class PriceCode(ABC):
    pass
class NewRelease(PriceCode):
    def get_price(self, days):
        return 3*days
```

1. Organizing Data, 2. Simplifying Conditional Expressions

#14 Hint

Answer is not *Replace Type Code with Subclass*

There are also classes (not shown to save space)

```
class ChildrensMovie(PriceCode):
    def get_price(self, days): ...

class RegularMovie(PriceCode):
    def get_price(self, days): ...
```

#15

BEFORE

```
SPADES = 1
HEARTS = 2
CLUBS  = 3
DIAMONDS = 4

class Card:
  def __init__(self, value,
              suite: int):
      ...

c = Card(4, HEARTS)
```

AFTER

```
class Suite(Enum):
   SPADES = 1
   HEARTS = 2
   CLUBS  = 3
   DIAMONDS = 4

class Card:
   def __init__(self, value,
            suite: Suite):
      ...
c = Card(4, Suite.HEARTS)
```

Organizing Data, but ***different refactoring from #12 - 14.***

Can You Justify Your Refactorings?

Imagine refactoring during a code review.

Can you explain to the team *why you refactor?*

For each refactoring, you *should* be able to:

- Explain the Benefits

- Be specific - no vague claims like "*easier to ...*"

Instead, state why and how something is "*easier*".

Example: Extract Method

Benefits:

- method *logic* becomes clearer, which reduces errors and improves maintainability
- the code you extract can be tested separately. When it is embedded in another method, it might not be testable.
- by reducing the amount of work a method is doing, it gets closer to the goal of "1 method does 1 thing", and make for more descriptive method name
- increase opportunity to reuse code and eliminate duplicate code

Refactoring is Not Always this Simple

These examples are very simple
in order to fit on one slide.

Actual code is much more complex.

...and the more complex the code is,
the more it (probably) needs refactoring.

It will help to know
1) refactoring signs and symptoms,
2) design principles.