601.220 Intermediate Programming

Summer 2022, Meeting 16 (July 15th)

Today's agenda

- Review exercise 27
- Day 28 recap questions
- Exercise 28

Reminders/Announcements

- HW6 is due **Friday, April 7th** by 11 pm
  - Written homework, no late submissions

Exercise 27 review

GradeList gl; gl.mean()

"receiver"

Part 2: `mean` and `median` functions

```
double GradeList::mean() {
  assert(!grades.empty());
  double sum = 0.0;
  for (std::vector<double>::const_iterator i = grades.cbegin();
       i != grades.cend();
       ++i) {
    sum += *i;
  }
  return sum / grades.size();
}

double GradeList::median() {
  return percentile(50.0);
}
```

belongs to receiver

Exercise 27 review

Part 3: in `main2.cpp`:

```
GradeList gl;

double min_so_far = 100.0;
for (size_t i = 0; i < gl.grades.size(); i++) {
  if (gl.grades[i] < min_so_far) {
    min_so_far = gl.grades[i];
  }
}
```

This does not work because `grades` is a private member of `GradeList`, so a `main` function (which is not a member of `GradeList`) cannot access it directly.

Exercise 27 review

Part 3: one possible solution is

```
// in grade_list.h (adding new public member functions)

  size_t get_num_grades() const { return grades.size(); }
  double get_grade(size_t i) const { return grades[i]; }

// in main2.cpp

  double min_so_far = 100.0;
  for (size_t i = 0; i < gl.get_num_grades(); i++) {
    if (gl.get_grade(i) < min_so_far) {
      min_so_far = gl.get_grade(i);
    }
  }
```

Exercise 27 review

Another possible solution: add to `grade_list.h` (in `GradeList` class)

```
const std::vector<double> &get_grades() const
  { return grades; }
```

In `main2.cpp`, change `gl.grades` to `gl.get_grades()`.

Arguably, this doesn't violation encapsulation because a `const` reference can't be used to modify the internal data of the `GradeList` object. However, it does result in "leaking" the knowledge that the grades in a `GradeList` are stored in a `std::vector<double>`.

Exercise 27 review

```cpp
// Part 4 (main3.cpp)
#include <iostream>
#include "grade_list.h"

int main() {
  GradeList gl;
  for (int i = 0; i <= 100; i += 2) {
    gl.add(double(i));
  }
  std::cout << "Minimum: " << gl.percentile(0.0) << std::endl;
  std::cout << "Maximum: " << gl.percentile(100.0) << std::endl;
  std::cout << "Median: " << gl.median() << std::endl;
  std::cout << "Mean: " << gl.mean() << std::endl;
  std::cout << "75th percentile: " << gl.percentile(75.0) << std::endl;
}
```

Day 28 recap questions

1. What is a non-default (or "alternative") constructor?
2. If we define a non-default constructor, will C++ generate an implicitly defined default constructor?
3. When do we use the `this` keyword?
4. What is a destructor?
5. A destructor will automatically release memories that are allocated in the constructor- true or false?

1. What is a non-default (or "alternative") constructor?

A non-default constructor has one or more parameters. Usually, these are used to initialize the field(s) of the object being initialized.

Example:

```
class Point {
private:
  double x, y;
public:
  Point() : x(0.0), y(0.0) { }  // default constructor
  Point(double x, double y)     // non-default constructor
    : x(x), y(y) { }
  // ... other member functions ...
};
```

2. If we define a non-default constructor, will C++ generate an implicitly defined default constructor?

No. For example:

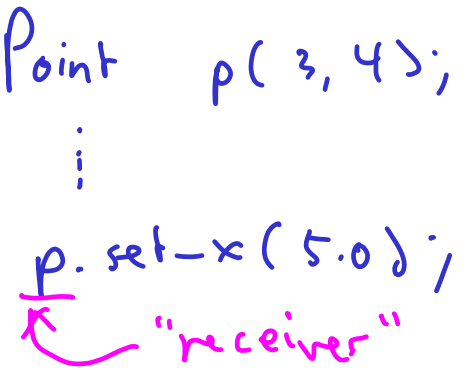
```
class Point {
private:
  double x, y;
public:
  Point(double x, double y)
    : x(x), y(y) { }
  // ... other member functions ...
};

// ...elsewhere...

Point p;  // will not compile
```

3. When do we use the `this` keyword?

The `this` keyword us useful for explicitly referring to the object a member function is called on, sometimes called the "receiver" object. It is a *pointer* to the receiver object.

Among other uses, `this` can be useful for disambiguating a member variable that has the same name as a parameter. Example:

```
class Point {
private:
  double x, y;
public:
  // ...
  void set_x(double x) { this->x = x; }
  // ...
};
```



4. What is a destructor?

A `class` (or `struct`) type's destructor member function is called automatically when an object's lifetime ends. It's purpose is to deallocate any dynamic resources associated with the object.

Examples of dynamic resources:

- dynamically allocated memory
- file resources not automatcially closed by a destructor

Destructor example

```
class CBuf {
private:
  char *buf;
  size_t size;

public:
  CBuf(size_t sz) : buf(new char[sz]), size(sz) { }
  ~CBuf() { delete[] buf; }

  // ...other member functions...
};
```

5. A destructor will automatically release memories that are allocated in the constructor- true or false?

False.

The destructor must *explicitly* deallocate dynamically-allocated memory using either `delete` or `delete[]` (depending on whether or not the memory being deallocated is an array.)

Exercise 28

- `grade_list` again, but this time storing grades in a dynamically allocated array
  - This is very much like how `std::vector` works!
- Talk to us if you have questions!

Notes

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