CSE 333 – SECTION 4

C++ References, const and classes

Reminders

- **HW2 due Thursday, July 19th**
- Midterm on Monday, July 23th
- Review section, Sunday, July 22nd (Time TBD)

This or that?

- Consider the following code:

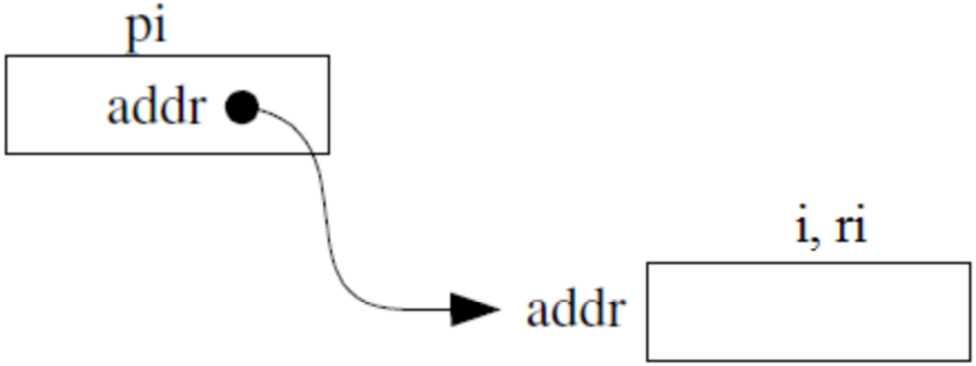
Pointers:

```
int i;
int *pi = &i;
```

References:

```
int i;
int &ri = i;
```

In both cases,



References are aliases – the same memory location with more than one name

```
*pi = 4;
```

```
ri = 4;
```

References Example

```
// Part 1
int i = 0, j = 4;
int *pi = &i;

// Part 2
int &ri = i;

// Part 3
*pi = 3;

// Part 4
 ri = j;
```

Pointers and References

- Once a reference is created, it cannot be later made to reference another object.
  - Compare to pointers, which are often reassigned.
- References can't be initialized to *null*, whereas pointers can.
- References can never be uninitialized. It is also impossible to reinitialize a reference.
- Demo: `experiments.cc`

C++ const declaration

- As a declaration specifier, const is a type specifier that makes objects unmodifiable.

```
const int m = 255;
```

- Reference to constant integer:

```
int n = 100;
const int &ri = n; // ri becomes read only
```

- Uses of const for magic numbers

```
const int BUFFER_SIZE = 100;
char input[BUFFER_SIZE]
```

- Demo: `const.cc`

When to use?

- **Pointers**: may point to many different objects during its lifetime. Pointer arithmetic (++ or --) enables moving from one address to another. (Arrays, for e.g.)
- **References**: can refer to only one object during its lifetime.
- **Style Guide Tip:**
  - use const reference parameters to pass input
  - use pointers to pass output parameters
  - input parameters first, then output parameters last

C++ Classes

```
/* Note: This code is unfinished! Beware! */
class Point {
 public:
  Point(const int x, const int y); // constructor
  int get_x() const { return x_; } // inline member function
  int get_y() const { return y_; } // inline member function
  double distance(const Point &p) const; // member function
  void setLocation(const int x, const int y); //member function

 private:
  int x_; // data member
  int y_; // data member
}; // class Point
```

Const Practice

Refer to the following poorly-written class declaration. (10 min)

```
class MultChoice {
 public:
  MultChoice(int q, char resp) : q_(q), resp_(resp) { }  // 2-arg ctor
  int get_q() const { return q_; }
  char get_resp() { return resp_; }
  bool Compare(MultChoice &mc) const;  // do these MultChoice's match?

 private:
  int  q_;      // question number
  char resp_;   // response: 'A','B','C','D', or 'E'
};  // class MultChoice
```

a) Indicate (**Y**/**N**) which *lines* of the snippets of code below (if any) would cause compiler errors:

```
const MultChoice m1(1,'A');
MultChoice m2(2,'B');
cout << m1.get_resp();
cout << m2.get_q();
```

```
const MultChoice m1(1,'A');
MultChoice m2(2,'B');
m1.Compare(m2);
m2.Compare(m1);
```

Section Exercise

- Define a class Rectangle whose instance variables are a pair of Point objects (upper left, lower right).
- Include at least one constructor. Make sure you get const right in the right places.
- Methods:
  - **getul(), getlr()** - returns upper and lower points. (upper-left, lower-right)
  - **intersect(Rectangle &r)** – returns a Rectangle representing the overlap.
  - **area()** - returns the Rectangle's area.
  - **contains(Point &p)** - returns true or false depending on whether point p is inside the rectangle.
- The C++ Primer text and cplusplus.com contain good reference material.