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Functions overload

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Functions with default parameters

```
void print(string s = "Hello world");

int main(){
      print("Ciao!!");
      print();
}
void print(string s){
      cout << s << endl;
}
```

It will overwrite the value in s.

this time, "Hello world" will be printed.

Overloaded functions (or methods!)

DEFINITION:

- Functions (methods) that have the same name but **different parameter** lists and that appear in the same scope are **overloaded**

```
void print(const string & s);
void print(const int ia[], size_t size);

int j[2] = {0,1};

print("Hello World");// calls print(const string &)
print(j, 2);// calls print(const int*, size_t)
```

Overloaded functions

- Overloaded functions must differ in the number or the type(s) of their parameters
- It is an error for two functions to differ only in terms of their return types

Example:

```
Record lookup(const Account&);
bool lookup(const Account&);// error: only the return
                            // type is different
```

Calling an overloaded function

- **Function matching** (also known as **overload resolution**) is the process by which a particular function call is associated with a specific function from a set of overloaded functions

- For any given call to an overloaded function, there are three possible outcomes:
  1. the compiler finds exactly one function that is a **best match**
  2. there is no function with parameters that match the arguments in the call. Error: **no match**
  3. there is more than one function that matches and none of the matches is clearly best. Error: **ambiguous call**

Calling an overloaded function

```
void f();
void f(int);
void f(int, int);
void f(double, double = 3.14);


f(5.6);
```

- Identify the set of overloaded functions considered for the call:
  - **candidate functions**
- Selects from the set of candidate functions those functions that can be called with the arguments in the given call:
  - **viable functions**

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Calling an overloaded function

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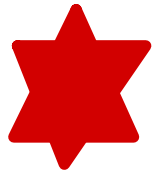
void f();
void f(int);
void f(int, int);
void f(double, double = 3.14);

f(5.6);
```

0 argument

2 arguments

- Viable functions: a function must have the **same number** of parameters as there are arguments in the call, and the type of each argument must:
  - **match**
  - or be **convertible** to the type of its corresponding parameter



Calling an overloaded function

- `f(int)` is viable because a conversion exists that can convert the argument of type double to the parameter of type int argument (5.6) is convertible to int.

- `f(double, double)` is viable because a default argument is provided for the function second parameter and its first parameter is of type double, which exactly matches the type of the parameter

Finding the *best* match, if any!

- Finally look at each argument in the call and select the viable function (or functions) for which the corresponding parameter best matches the argument
  - the closer the types of the argument and parameter are to each other, the better the match

- `f(int)` requires to convert the argument from double to int
- `f(double, double)`, is an exact match for this argument

- An exact match is better than a match that requires a conversion

- We call `f(double, double)`!

Function matching with multiple parameters

- `f(42, 2.56);`

- The viable functions are **`f(int, int)`** and **`f(double, double)`**

PAOP :

- There is an overall best match if there is one and only one function for which:
  - the match for each argument is no worse than the match required by any other viable function
  - there is at least one argument for which the match is better than the match provided by any other viable function

- If after looking at each argument there is no single function that is preferable, then the call is in error (ambiguous call)

Function matching with multiple parameters

- Consider the **first argument**
  - `f(int, int)` is an exact match ← this one is better (for 1st arg.).
  - `f(double, double)`: the int argument 42 must be converted to double
  - A match through a built-in conversion is “less good” than one that is exact
- Consider the **second argument**

this one is better (for 2nd arg.)

  - `f(double, double)` is an exact match to the argument 2.56
  - `f(int, int)`: the double argument 2.56 must be converted from double to int

- The compiler will reject this call because it is **ambiguous**
- In well-designed systems, argument casts should not be necessary

Overloading and `const` parameters

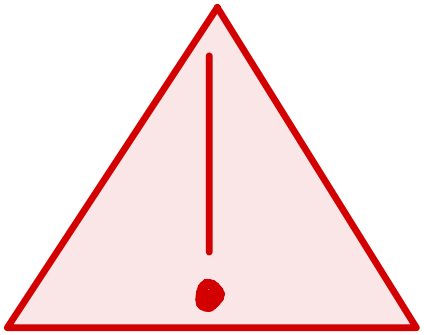
- A parameter that has a top-level const is indistinguishable from one without a top-level const

```
Record lookup(Phone);
Record lookup(const Phone); // redeclares
                            // Record lookup(Phone)
```

Overloading and `const` parameters

- We can overload based on whether the parameter is a reference (or pointer) to the const or nonconst version of a given type

```
Record lookup(Account&);// function that takes a reference
                        // to Account
Record lookup(const Account&);// new function that takes
                              // a const reference
```



Overloading member functions

- As with nonmember functions, member functions may be overloaded
- The same function-matching process is used for calls to member functions as for nonmember functions

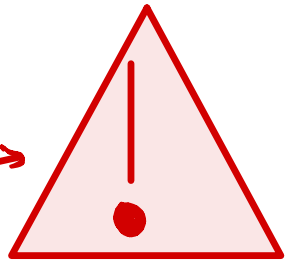
```
class Screen{
private:
      unsigned x, y;
      char content[40][80];
public:
      char get() const;
      char get(unsigned x, unsigned y) const;
};

Screen myscreen;
char ch = myscreen.get();// calls Screen::get()
ch = myscreen.get(0,0);  // calls Screen::get(unsigned, unsigned)
```

Overloading based on `const`

- We can overload a member function based on whether it is `const`

```
class C{
public:
        f() const;
        f();
}
```



- The non-`const` version will not be viable for `const` objects; we can only call `const` member functions on a `const` object
- We can call either version on a non-`const` object, but the non-`const` version will be a better match

DEMO

References

- Lippman Chapters 6, 7