

# Function overloading (ad hoc polymorphism)

Michael Nowak

Texas A&M University

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## Introduction

- ▶ Functions that have the same name but different parameter lists *and* appear in the same scope are overloaded
- ▶ Function overloading is also known as ad hoc polymorphism
  - ▶ Polymorphism comes from the Greek word *poly* meaning “many, much” and *morphē* meaning “form, shape”; a polymorphic function provides different implementations depending on the type of argument(s) to which it is applied
  - ▶ Ad hoc refers to notion that the overloaded functions have been defined explicitly for distinct parameter configurations

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## Motivation

- ▶ Eliminates the need to define different names for functions that perform the same general action but in a different way dependent on the parameter types
- ▶ Instead of providing different names, we can use the same name and let the compiler figure out which function to call based on the types arguments in a call
- ▶ For instance, there is only one name for addition, yet it can be used to add values of the arithmetic types
  - ▶ When a name is semantically significant, the convenience of overloading becomes practically essential

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## Defining overloaded functions

- ▶ When we overload functions, we are creating multiple functions that have the:
  - ▶ Same name
  - ▶ Different parameter configurations
    - ▶ Number of parameters
    - ▶ Types of parameters
    - ▶ Order for parameter types
- ▶ C++ forbids functions that differ only in return type; this would introduce ambiguity as to which function is to be called

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## Defining overloaded functions

- ▶ Using function overloading we can declare a family of functions that return whether two 'values', or a collection of 'values', are equal:

```
bool areEqual(int a, int b);
bool areEqual(double a, double b);
bool areEqual(char a, char b);
bool areEqual(char *a, char *b);
```
- ▶ How would you define these functions?

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## Calling an overloaded function

- `Overload resolution` is the process by which the compiler determines which specific function is called from a set of overloaded functions
- The compiler determines this by comparing the arguments against the parameters of each function in the set of overloaded functions

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## Calling an overloaded function

- For now, lets consider the following outcomes:
  - The compiler finds exactly one function whose parameter(s) is(are) a `best match` for the actual argument(s):
    - An exact match
    - A match through a promotion: `char` to `int`, `float` to `double`, etc.
    - A match using standard conversions: `int` to `double`, `double` to `int`, etc.
    - ...
  - If there is no function with parameters that are a best match (exact match or compatible with) the arguments; compiler will report `there was no match`
  - If there is more than one function that matches and amongst the matches, there isn't a best match; the compiler will report `an ambiguous call`

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Overloading guidance

- ▶ You should use `function overloading` when a name is semantically significant amongst different data types
- ▶ Otherwise, you should probably construct functions that are identified by different names

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## References

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- ▶ Stroustrup, B. (2014). *Programming: principles and practice using C++* (2nd ed.). Addison-Wesley.

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