Exercises week 1: Function Templates

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Exercise 1

Show that templates don't result in 'code bloat'

A function template `add` and a union `PointerUnion` were defined in separate header files. We use this union to print the address of the function `add`. There are two source files, one for `fun` and one for `main`. The function `fun`, which includes `add.h`, instantiates `add` for `int`s and prints its address. Then, in `main` the same happens and `fun` is called. When the two source files of `fun` and `main` are compiled to object modules, they both contain an instantiation of `add`. Then they are linked to obtain an executable. The output of this executable gives two identical addresses, which means that only one instantiation of `add` is present. So the linker prevents 'code bloat'.

`add.h`

```
1 template <typename Type>
2
3 Type add(Type const &lhs, Type const &rhs)
4 {
5     return lhs + rhs;
6 }
```

`pointerunion.h`

```
1 union PointerUnion
2 {
```

```
3       int (*fp)(int const &, int const &);
4       void *vp;
5   };
```

fun.cc

```
1   #include <iostream>
2   #include "add.h"
3   #include "pointerunion.h"
4
5   void fun()
6   {
7       PointerUnion pu = { add };
8
9       std::cout << pu.vp << '\n';
10  }
```

main.cc

```
1   #include <iostream>
2   #include "add.h"
3   #include "pointerunion.h"
4
5   void fun();
6
7   int main()
8   {
9       PointerUnion pu = { add };
10
11      fun();
12      std::cout << pu.vp << '\n';
13  }
```

Exercise 2

Exercise 3

Exercise 4

Exercise 5