CS50 Typecasting

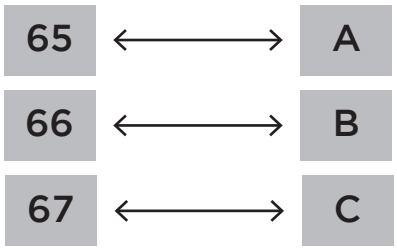
Overview

Recall that C has several different data types, including `int`s, `float`s, and `char`s. It may sometimes be necessary to convert variables from one data type to another data type. C allows us to do this via **typecasting** (or just "casting"). Typecasting allows you to cast data from one type to another type which is equally or less precise, but you cannot cast data from a type that is less precise to a type that is more precise.

Key Terms

- typecasting
- explicit typecasting
- implicit typecasting

```
1 | #include <stdio.h>
2 |
3 | int main(void)
4 | {
5 |     int x = 65;
6 |     printf("%i\n", x); // 65
7 |     printf("%c\n", (char) x); // A
6 | }
```



Chars and Ints

The ASCII standard, as you may recall, gives every letter a unique number to identify it: where capital A is represented by the number 65, capital B by 66, and so on. Using typecasting, we can convert between integer values to and from `char` values.

Say, for instance, that we assigned an integer variable `x` to hold the value `65`. If we were to print the variable out on the screen (like on line 6 of the code to the left), then it would display the number `65` to the console.

On line 7, however, we've included a placeholder for a `char` instead of an `int` (as denoted by the `%c` symbol). We're still passing in `x` as an argument, but the code first casts `x` into a `char`. This is done by writing `(char)` in parentheses before the name of the variable. Placing a new type name in front of an existing variable to evaluate the variable as a differnet type is called **explicitly typecasting**: we are directly providing instructions to convert types.

While explicit typecasting in this situation is good practice from a style perspective (so that people reading your code can better understand what's happening), it's not actually necessary. If we were to exclude the `(char)` symbol from before the `x` in line 7 of the above code, the code will still print out the letter `A` (the ASCII mapping of the value `65`). Since we've included a placeholder for a `char`, the compiler is expecting a `char` to be passed in. If we pass an `int` in, the compiler will automatically try to interpret the value as a `char` instead. This is called **implicit typecasting**.

Ints and Floats

Typecasting is also valuable for converting between floating-point numbers and integers. Take the example at right. On line 6, we might want `b` to store the value of 28 divided by 5, which is 2.4. But line 6 actually sets `b` to be `2.0`. This is because the compiler sees a division between two `int`s, and thus presents the answer as an `int`, even though we're storing the value inside of a `float`. To get around this, we can first explicitly cast `a` to be a float, and then perform the division, as is done on line 7. In this case, `c` now correctly equals `2.4`.

Implicit typecasting can also be valuable when dealing with `int`s and `float`s. Since `int`s can't store information past the decimal point, converting a `float` to an `int` is an easy way to store just the whole number part of a floating-point value. On line 10 to the right, when we try to assign an `int` to be a floating-point value, `d` is implicitly cast to be an `int`, getting rid of everything after the decimal point. The value of `e` is now just `28`.

```
1  | #include <stdio.h>
2  |
3  | int main(void)
4  | {
5  |     int a = 28;
6  |     float b = a / 5;
7  |     float c = (float) a / 5;
8  |
9  |     float d = 28.523;
10 |     int e = d;
11 | }
```