Computer Programming: Skills & Concepts (INF-1-CP)
Practical Programming

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This Lecture

- writing a program from scratch
- basic debugging with `printf`

The Task

Write a program which requests two (decimal) integers `n` *and* `b` *from the user, and prints the representation of* `n` *in base* `b`*.*

Numbers in different bases

Our usual way of writing numbers is decimal or *base 10*:
345 means $3 \times 10^2 + 4 \times 10^1 + 5 \times 1$.

It is sometimes convenient to use other bases. In computing, we often use base 16 (hexadecimal), with digits 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F. For example:
$1C7_{16} = 1 \times 16^2 + 12 \times 16^1 + 7 = 455$.

Internally, computers use base 2 (binary):
$100111_2 = 1 \times 2^5 + 0 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 = 39$

Some bases used by other cultures include 2, 5, 10, 12, 20, 60. (And of course traditional measurements use mixed and fractional bases: 12 inches to a foot, 3 feet to a yard, $5\frac{1}{2}$ yards to a rod, 4 rods to a chain, 10 chains to a furlong, 8 furlongs to a mile. Let's not go there.)

First Step

Stop!

Think!

Is the task specification complete? If not, what decisions do we need to make?

Plan

- Set up skeleton program;
- develop program incrementally;
- at each stage, insert debugging information;
- at each stage, test.

Setting Up

For trivial programs like this, can just type from nothing.
In larger settings, will often copy pre-existing template (as done in labs).

Skeleton Program

```
#include <stdlib.h>
#include <stdio.h>

int main(void) {

  return EXIT_SUCCESS;
}
```

And on with the job

Tips to remember

Check the program compiles after every change – and keep changes small.
Test functionality whenever you can.
Write test functions if possible.
If you don't understand what your program is doing, add `printfs` and trace what's happening to your variables.
(Advanced: use a *debugger* – but they have a steep learning curve.)
Edit–compile–run should be thought of as
edit–compile–test.