C Programming Tools: Part 3

Building your own Tools

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The handout and tarballs are available on materials.doc.ic.ac.uk and at:

`http://www.doc.ic.ac.uk/~dcw/c-tools-2021/lecture3/`

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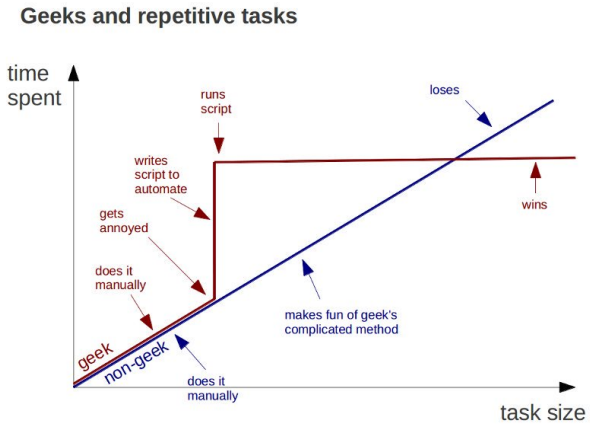
- Let's see an example of those tips together, remembering..



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- Let's assume the input format is an `F,Op` pair. In C terms, the corresponding output would be produced by:

```
printf( "int %s( int a, int b ) { return (a%sb); }\n", F, Op )
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- I wrote it in C in 15 minutes using standard library function strtok() to split on comma: See 01.tiny-tool/genfuncs1.c.

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- Why not let the user change the type at any point in the input:

```
TYPE,int
plus,+
minus,-
TYPE,double
plus,+
minus,-
```

generates:

```
int    int_plus       ( int a, int b ) { return (a+b); }
int    int_minus      ( int a, int b ) { return (a-b); }
double double_plus    ( double a, double b ) { return (a+b); }
double double_minus   ( double a, double b ) { return (a-b); }
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- To implement this, we'll need to treat lines where `$f eq "TYPE"` specially:

```
perl -nle '($f,$op)=split(/,/); if( $f eq "TYPE" ) { $t=$op; next; }
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- Final thought, instead of hardcoding the output format in the printf, we could replace TYPEs with TEMPLATEs in the input, for example:

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- Here, the marker <0> means "replace this marker with the current value of the first field". Our Perl one-liner becomes more powerful but shorter:

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perl -nle '@f=split(/,/,$_,2); if( $f[0] eq "TEMPLATE" ) { $t=$f[1]; next; }
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- This is now a simple template processor. See `01.tiny-tool/README` for further extensions, allowing any number of marker fields, and how to turn our one-liner into a proper command with a man page (install it via `make install`).

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- The problem here is that there's a lot of repetition between the .c file and the .h file. This violates the single most important Pragmatic Programmers tip: DRY - Don't Repeat Yourself (tip 11).

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- See `http://www.doc.ic.ac.uk/~dcw/PSD/article4/` for an article I wrote about how easy similar editor extensions can be.

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- Note: Reuse can be done without OO or generics, *Make it Easy to Reuse* (PP Tip 12) - in C, use `void *` for generic pointers, and use pointers to functions for callbacks.

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- Note also **tarball 05.utils** contains a couple of reusable utility modules - two safe line readers, and a CSV splitter. I intended to include a .ini file parser too; but I've never needed one:-) Do make install in that directory now.

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- Cost/benefit analysis: a serious tool, a mini-compiler (with parser, lexical analyser, data structures, tree walking code generator): at least a week's work! Think hard!

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- ... change types.in later - suppose you realise that a tree node also needs to store a name (just as the leaves do). Change the type defn, rerun datadec. The `tree_node()` constructor now takes 3 arguments!

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- Then two deconstructor functions which, given a tree of the appropriate shape, breaks it into it's constituent pieces:

```
extern void get_tree_leaf( tree t, string *namep );
extern void get_tree_node( tree t, tree *lp, tree *rp );
```

- These allow you to write tree-walking code like this leaf-counter:

```
int nleaves( tree t )
{
    if( tree_kind(t) == tree_is_leaf )
    {
        string name; get_tree_leaf( t, &name );
        return 1;              // leaf( name ): contains 1 leaf.
    } else
    {
        tree l, r; get_tree_node( t, &l, &r );
        // node( l, r ): process l and r trees.
        return nleaves(l) + nleaves(r);
    }
}
```

- In Haskell, this'd be:

```
nleaves(leaf(name)) = 1
nleaves(node(l,r))  = nleaves(l) + nleaves(r)
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- You can read a 3-part article I wrote about how I designed datadec here:

`http://www.doc.ic.ac.uk/~dcw/PSD/article8/`

Remember:

(and learn Perl, it's great!)