

Let's Write `ntohl` as an Example

Standard library function `ntohl`

- “net to host long”
- **swaps bytes in a 32-bit value.**

Let's write it and test it.

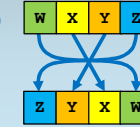
Here's a sample function signature:

```
int32_t ntohl (int32_t arg);
```

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Shift and Copy One Byte at a Time

```
int32_t ntohl (int32_t arg)
{
    int32_t res;
    res = (arg << 24);
    res |= ((arg & 0xFF00) << 8);
    res |= ((arg >> 8) & 0xFF00);
    res |= (arg >> 24);
    return res;
}
```



How can we test the code?

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Let's Use Undergraduates to Write Tests

How about ...

- each of you writes 125 tests
- along with the correct answer for each?
- Together we'll have about **5,000 tests.**

Seem expensive?

That's why I want to use undergraduates!

An engineer costs 5-10× more!

Maybe we should think harder?

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Test All Possible Inputs?

Another idea: how about ...

- we find a way to come up with answers
- and we **test all possible inputs**
- (there are only 2^{32}).

Generally not the best strategy.

Has the 64-bit adder in your laptop

- been tested that way?
- Even at 10 GHz, testing 2^{129} input combinations
- takes over 2×10^{21} years. So ... no.

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