



CS1632: Lecture 18



Pairwise and Combinatorial Testing
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Let's test a word processor

10 font effects

- Italic
- Bold
- Underline
- Strikethrough
- Superscript
- Shadow
- Embossed
- 3D
- Outline
- Inverse

Fonts may be combined

Plain text

Superscript

Bold

~~Italic and strikethrough~~

Bold and underlined

~~Bold italic strikethrough superscript~~

Comprehensive testing

You would need to execute 2^{10} tests to comprehensively test all the possible font combinations.

1,024 tests

Comprehensive testing is not necessary

Source: “Practical Combinatorial Testing”,

<http://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-142.pdf>

- Think of each font effect as a boolean variable. For example, bold vs. not bold, italic vs. not italic, etc.
- Most (50%-90%) defects come from combinations of one or two interactions.
- In other words, most defects would be found if you just tested bold 3D text (two interactions) or just bold text (one interaction).
- The maximum number of interactions found to cause a defect was six.

Combinatorial testing

By carefully selecting test cases, we can provide a reasonable assurance of quality with a subset of the tests required for comprehensive testing.

Pairwise testing (t = 2)

A type of combinatorial testing in which the tester tests all possible pairs of interactions.

Test #	Bold	Italic	Underlined
1	TRUE	TRUE	FALSE
2	TRUE	FALSE	TRUE
3	FALSE	TRUE	TRUE
4	FALSE	FALSE	FALSE

What about pairwise testing all 10 font effects?

It was 1,024 tests to comprehensively test.

How many tests would it require to test all pairs of interactions?

<https://github.com/asphaltpanthers/IS2545/blob/master/examples/Lecture16/FontEffectsPairwise-output.xls>

Rule of nines

Pairwise testing finds 90% of bugs.

Three way 99% of bugs.

Four way 99.9% of bugs.

Five way 99.99% of bugs

Six way 99.999% of bugs.

...

Six way testing of 10 font effects ($t = 6$)

<https://github.com/asphaltpanthers/IS2545/blob/master/examples/Lecture16/FontEffectsSixWay-output.xls>

The number of tests we need to add to increase t increase exponentially.

As we increase t , our tests become less and less valuable because they find less and less defects.

Covering arrays

<https://www.david-merrick.com/2017/06/06/how-to-use-the-acts-tool-for-combinatorics-testing/>