

Pairwise Testing Explained

ANZTB Special Interest Group

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Pairwise Testing

Pairwise Testing is a technique whereby, when we need to test combinations of conditions, we can dramatically reduce our total number of test cases by removing most of them in such a way that we still ensure that each *pair* of conditions is tested at least once.

The pairwise approach works because many faults are triggered by *pairs* of conditions (meaning that we may not need to test every possible combination of conditions).

However, please note that pairwise testing on its own may not be enough in all situations, so we need to understand whether any special circumstances exist in our testing scenarios.

Methods

Several methods for obtaining pairwise test cases exist. Two automated methods and a manual method are described below.

Allpairs Test Case Generation Tool (by James Bach)

You can obtain this free tool via the Satisfice website at: <http://www.satisfice.com>.

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Welcome! Satisfice, Inc. is a company founded and operated by me, James Bach. Satisfice is dedicated to software testing and quality assurance. Many testing companies consist of business people trying to provide more like a craftsman who runs a business. What you'll find at this Satisfice website is mainly interesting a

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Alan Mukai	Mark Barnes	Jacob Hills	Lacey Staker
Pearl Sequeira	Ben Johnson	Marlene Harrison	Rozchel Yap
Lalithkumar Bhamare	Tanjai Kongyuen	Minouche Du	Jaemin Yu
Griffin Jones	Emy Moreno	Paul Holland	Sarah Fallon
Anne-Marie Charrett	Zeff Morgan	Chris Kenst	Slavash Solati



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Test Tools

This is a repository of some test tools written, in whole or part, by James Bach, or authorized to be distributed by him. These tools are free and open source. They are offered under the GPL 2.0 license.

ALLPAIRS Test Case Generation Tool (Version 1.2.1)

Download ALLPAIRS (ZIP format; includes a little tutorial and example)

Let's say you must test something that involves a lot of different variables. Configuration testing is like that: different printers, different print options, different documents. Who knows what combination will fail? But you can't try all combinations of all variables together, because that would be too many tests. So instead, you could create tests that pair each value of each of the variables with each value of each other variable at least once. Allpairs is a tool I wrote that will find a reasonably small set of test cases to satisfy that coverage standard. For instance, to try all combinations of 10 variables with ten values each would require 10,000,000,000 test cases. Allpairs only requires 177 cases. Allpairs is a command-line executable based on a Perl script. Source is included.

After you download and unzip the ALLPAIRS zip file you will find that, as well as the allpairs.exe program, it includes a little tutorial, an example, and instructions on how to run the program (in allpairs.rtf).

To use this tool you:

1. Prepare your input in Excel
2. Save the Excel file as a TAB delimited text file
3. Run **allpairs.exe** from a command prompt, specifying its input and output files, for example:
allpairs InputFileName.txt > OutputFileName.txt
4. Open the output file with Excel to see the test cases that were generated.

PICT Program (free from Microsoft)

This program is described in "Pairwise Testing in the Real World: Practical Extensions to Test-Case Scenarios" by Jacek Czerwonka, which can be found at: <http://msdn.microsoft.com/en-us/library/cc150619.aspx>.

It can be downloaded from: <http://download.microsoft.com/download/f/5/5/f55484df-8494-48fa-8dbd-8c6f76cc014b/pict33.msi>.

The download is a Microsoft Installer Package, which you will first save and then execute to install (it installs into a directory called PICT in the Program Files folder). After the install the PICT directory will contain the **pict.exe** program and a useful file called **PICTHelp.htm**.

To use this tool you:

1. Prepare your input file in Notepad as a text file
2. Run **pict.exe** from a command prompt, specifying its input and output files, for example:
pict SkypeExampleForPICT.txt > SkypeTestCasesFromPICT.txt
3. Open the output file with Excel to see the test cases that were generated.

Orthogonal Arrays

This method relies on finding an orthogonal array that matches, or can be adapted to, your situation. It works because the design of an orthogonal array guarantees that each pair of conditions will occur at least once, however, it is more labour intensive than the two automated methods described above.

You can find a library of 117,000 orthogonal arrays of different sizes, by Warren Kuhfeld, at: <http://support.sas.com/techsup/technote/ts723.html>.

Further Information

Copeland, L. 2004. *A practitioner's guide to software test design*. Boston, Mass.: Artech House. [Chapter 6 consists of 32 pages on Pairwise Testing, covering orthogonal arrays in detail, as well as Bach's Allpairs tool].

Kaner, C., Bach, J. and Pettichord, B. 2002. *Lessons learned in software testing*. New York: Wiley. [Pages 52-60 describe how to do All Pairs manually].

Google "pairwise testing" to find other useful websites, tools, and materials.

Acknowledgement

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Contact

Feel free to send me an e-mail if you have any questions, at: thomasmccoy@anztb.org.