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JMASM Editors

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# The fastest, most comprehensive and robust permutation test software on the market today.

Permutation tests increasingly are the statistical method of choice for addressing business questions and research hypotheses across a broad range of industries. Their distribution-free nature maintains test validity where many parametric tests (and even other nonparametric tests), encumbered by restrictive and often inappropriate data assumptions, fail miserably. The computational demands of permutation tests, however, have severely limited other vendors' attempts at providing useable permutation test software for anything but highly stylized situations or small datasets and few tests. Permutelt<sup>™</sup> addresses this unmet need by utilizing a combination of algorithms to perform non-parametric permutation tests very quickly – often more than an order of magnitude faster than widely available commercial alternatives when one sample is large and many tests and/or multiple comparisons are being performed (which is when runtimes matter most). Permutelt<sup>TM</sup> can make the difference between making deadlines, or missing them, since data inputs often need to be revised, resent, or recleaned, and one hour of runtime quickly can become 10, 20, or 30 hours.

In addition to its speed even when one sample is large, some of the unique and powerful features of Permutelt<sup>TM</sup> include:

• the availability to the user of a <u>wide range of test statistics</u> for performing permutation tests on continuous, count, & binary data, including: pooled-variance t-test; separate-variance Behrens-Fisher t-test, scale test, and joint tests for scale and location coefficients using nonparametric combination methodology; Brownie et al. "modified" t-test; skew-adjusted "modified" t-test; Cochran-Armitage test; exact inference; Poisson normal-approximate test; Fisher's exact test; Freeman-Tukey Double Arcsine test

• <u>extremely fast exact inference</u> (no confidence intervals – just exact p-values) for most count data and high-frequency continuous data, often several orders of magnitude faster than the most widely available commercial alternative

• the availability to the user of a <u>wide range of multiple testing procedures</u>, including: Bonferroni, Sidak, Stepdown Bonferroni, Stepdown Sidak, Stepdown Bonferroni and Stepdown Sidak for discrete distributions, Hochberg Stepup, FDR, Dunnett's one-step (for MCC under ANOVA assumptions), Single-step Permutation, Stepdown Permutation, Single-step and Stepdown Permutation for discrete distributions, Permutation-style adjustment of permutation p-values

fast, efficient, and automatic generation of all pairwise comparisons

• <u>efficient variance-reduction</u> under conventional Monte Carlo via self-adjusting permutation sampling when confidence intervals contain the user-specified critical value of the test

• <u>maximum power</u>, and the shortest confidence intervals, under conventional Monte Carlo via a new sampling optimization technique (see Opdyke, JMASM, Vol. 2, No. 1, May, 2003)

• <u>fast permutation-style p-value adjustments for multiple comparisons</u> (the code is designed to provide an additional speed premium for many of these resampling-based multiple testing procedures)

• <u>simultaneous permutation testing and permutation-style p-value adjustment</u>, although for relatively few tests at a time (this capability is not even provided as a preprogrammed option with any other software currently on the market)

For Telecommunications, Pharmaceuticals, *f*MRI data, Financial Services, Clinical Trials, Insurance, Bioinformatics, and just about any data rich industry where large numbers of distributional null hypotheses need to be tested on samples that are not extremely small and parametric assumptions are either uncertain or inappropriate, Permutelt<sup>TM</sup> is the optimal, and only, solution.

To learn more about how Permutelt<sup>™</sup> can be used for your enterprise, and to obtain a demo version, please contact its author, J.D. Opdyke, President, DataMinelt<sup>SM</sup>, at JDOpdyke@DataMinelt.com or www.DataMinelt.com.

DataMinelt<sup>SM</sup> is a technical consultancy providing statistical data mining, econometric analysis, and data warehousing services and expertise to the industry, consulting, and research sectors. Permutelt<sup>TM</sup> is its flagship product.

## Two Years in the Making...

## Intel® Visual Fortran 8.0

The next generation of Visual Fortran is here! Intel Visual Fortran 8.0 was developed jointly by Intel and the former DEC/Compaq Fortran engineering team.



#### **Visual Fortran Timeline**

**1997** DEC releases Digital Visual Fortran 5.0

**1998** Compaq acquires DEC and releases DVF 6.0

1999 Compaq ships CVF 6.1

2001 Compaq ships CVF 6.6

2001 Intel acquires CVF engineering team

2003 Intel releases Intel Visual Fortran 8.0

#### Intel Visual Fortran 8.0

CVF front-end +
Intel back-end

- Better performance
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- Real\*16

#### Performance

Outstanding performance on Intel architecture including Intel<sup>®</sup> Pentium<sup>®</sup> 4, Intel<sup>®</sup> Xeon<sup>™</sup> and Intel Itanium<sup>®</sup> 2 processors, as well as support for Hyper-Threading Technology.

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- Plugs into Microsoft Visual Studio\* .NET
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> -Dr. Robert R. Trippi Professor Computational Finance University of California, San Diego

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#### NCSS 329 North 1000 East Kaysville, Utah 84037



#### Announcing NCSS 2004 Seventeen New Procedures

#### NCSS 2004 is a new edition of our popular statistical NCSS package that adds seventeen new procedures.

#### **New Procedures**

**Two Independent Proportions** Two Correlated Proportions **One-Sample Binary Diagnostic Tests Two-Sample Binary Diagnostic Tests** Paired-Sample Binary Diagnostic Tests **Cluster Sample Binary Diagnostic Tests** Meta-Analysis of Proportions Meta-Analysis of Correlated Proportions Meta-Analysis of Means Meta-Analysis of Hazard Ratios Curve Fitting **Tolerance Intervals Comparative Histograms ROC** Curves Elapsed Time Calculator T-Test from Means and SD's Hybrid Appraisal (Feedback) Model

#### **Documentation**

The printed, 330-page manual, called *NCSS User's Guide V*, is available for \$29.95. An electronic (pdf) version of the manual is included on the distribution CD and in the Help system.

#### **Two Proportions**

Several new exact and asymptotic techniques were added for hypothesis testing (null, noninferiority, equivalence) and calculating confidence intervals for the difference, ratio, and odds ratio. Designs may be independent or paired. Methods include: Farrington & Manning, Gart & Nam, Conditional & Unconditional Exact, Wilson's Score, Miettinen & Nurminen, and Chen.

#### **Meta-Analysis**

Procedures for combining studies measuring paired proportions, means, independent proportions, and hazard ratios are available. Plots include the forest plot, radial plot, and L'Abbe plot. Both fixed and random effects models are available for combining the results.

#### **Curve Fitting**

This procedure combines several of our curve fitting programs into one module. It adds many new models such as Michaelis-Menten. It analyzes curves from several groups. It compares fitted models across groups using computerintensive randomization tests. It computes bootstrap confidence intervals.

#### **Tolerance Intervals**

This procedure calculates one and two sided tolerance intervals using both distribution-free (nonparametric) methods and normal distribution (parametric) methods. Tolerance intervals are bounds between which a given percentage of a population falls.

#### **Comparative Histogram**

This procedure displays a comparative histogram created by interspersing or overlaying the individual histograms of two or more groups or variables. This allows the direct comparison of the distributions of several groups.

#### **Random Number Generator**

Matsumoto's Mersenne Twister random number generator (cycle length > 10\*\*6000) has been implemented.

#### **Binary Diagnostic Tests**

Four new procedures provide the specialized analysis necessary for diagnostic testing with binary outcome data. These provide appropriate specificity and sensitivity output. Four experimental designs can be analyzed including independent or paired groups, comparison with a gold standard, and cluster randomized.

#### **ROC Curves**

This procedure generates both binormal and empirical (nonparametric) ROC curves. It computes comparative measures such as the whole, and partial, area under the ROC curve. It provides statistical tests comparing the AUC's and partial AUC's for paired and independent sample designs.

#### Hybrid (Feedback) Model

This new edition of our hybrid appraisal model fitting program includes several new optimization methods for calibrating parameters including a new genetic algorithm. Model specification is easier. Binary variables are automatically generated from class variables.

#### **Statistical Innovations Products**

Through a *special arrangement* with Statistical Innovations (S.I.), NCSS customers will receive \$100 discounts on: Latent GOLDÒ - latent class modeling SI-CHAIDÒ - segmentation trees GOLDMineRÒ - ordinal regression For demos and other info visit:

www.statisticalinnovations.com

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	NCSS 2004 User's Guide V, \$29.95	\$
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	PASS 2002 Deluxe, \$499.95	\$
	Latent Gold® from S.I., \$995 - \$100 NCSS Discount = \$895	\$
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#### Forest Plot of Odds Ratio

COUNTRY



#### **Statistical and Graphics Procedures Available in NCSS 2004**

#### Analysis of Variance / T-Tests

Analysis of Covariance Analysis of Variance Barlett Variance Test Crossover Design Analysis Factorial Design Analysis Friedman Test Geiser-Greenhouse Correction General Linear Models Mann-Whitney Test MANOVA Multiple Comparison Tests **One-Way ANOVA** Paired T-Tests Power Calculations **Repeated Measures ANOVA** T-Tests – One or Two Groups T-Tests - From Means & SD's Wilcoxon Test

#### Time Series Analysis

ARIMA / Box - Jenkins Decomposition Exponential Smoothing Harmonic Analysis Holt - Winters Seasonal Analysis Spectral Analysis Trend Analysis Plots / Graphs Bar Charts Box Plots Contour Plot Dot Plots Error Bar Charts Histograms Histograms: Combined\* Percentile Plots Pie Charts Probability Plots ROC Curves' Scatter Plots Scatter Plot Matrix Surface Plots Violin Plots

#### **Experimental Designs**

Balanced Inc. Block Box-Behnken Central Composite D-Optimal Designs Fractional Factorial Latin Squares Placket-Burman Response Surface Screening Taguchi **Regression / Correlation** All-Possible Search Canonical Correlation Correlation Matrices Cox Regression Kendall's Tau Correlation Linear Regression Logistic Regression Multiple Regression Nonlinear Regression PC Regression Poisson Regression Response-Surface **Ridge Regression Robust Regression** Stepwise Regression Spearman Correlation Variable Selection

#### **Quality Control**

Xbar-R Chart C, P, NP, U Charts Capability Analysis Cusum, EWMA Chart Individuals Chart Moving Average Chart Pareto Chart R & R Studies

Survival / Reliability Accelerated Life Tests Cox Regression Cumulative Incidence Exponential Fitting Extreme-Value Fitting Hazard Rates Kaplan-Meier Curves Life-Table Analysis Lognormal Fitting Log-Rank Tests Probit Analysis Proportional-Hazards **Reliability Analysis** Survival Distributions Time Calculator\* Weibull Analysis

#### Multivariate Analysis

Cluster Analysis Correspondence Analysis Discriminant Analysis Factor Analysis Hotelling's T-Squared Item Analysis Item Response Analysis Loglinear Models MANOVA Multi-Way Tables Multidimensional Scaling Principal Components Curve Fitting Bootstrap C.I.'s\* Built-In Models Group Fitting and Testing\* Model Searching Nonlinear Regression Randomization Tests\* Ratio of Polynomials User-Specified Models

#### Miscellaneous

Area Under Curve Bootstrapping Chi-Square Test Confidence Limits Cross Tabulation Data Screening Fisher's Exact Test Frequency Distributions Mantel-Haenszel Test Nonparametric Tests Normality Tests Probability Calculator Proportion Tests Randomization Tests Tables of Means, Etc. Trimmed Means Univariate Statistics

#### Meta-Analysis\*

Independent Proportions\* Correlated Proportions\* Hazard Ratios\* Means\*

#### Binary Diagnostic Tests\*

One Sample\* Two Samples\* Paired Samples\* Clustered Samples\*

#### Proportions

Tolerance Intervals\* Two Independent\* Two Correlated\* Exact Tests\* Exact Confidence Intervals\* Farrington-Manning\* Fisher Exact Test Gart-Nam\* Method McNemar Test Miettinen-Nurminen\* Wilson's Score\* Method Equivalence Tests\* Noninferiority Tests\*

#### Mass Appraisal

Comparables Reports Hybrid (Feedback) Model\* Nonlinear Regression Sales Ratios

# **PASS 2002**

## Power Analysis and Sample Size Software from NCSS

**PASS** performs power analysis and calculates sample sizes. Use it before you begin a study to calculate an appropriate sample size (it meets the requirements of government agencies that want technical justification of the sample size you have used). Use it after a study to determine if your sample size was large enough. **PASS** calculates the sample sizes necessary to perform all of the statistical tests listed below.

A power analysis usually involves several "what if" questions. *PASS* lets you solve for power, sample size, effect size, and alpha level. It automatically creates appropriate tables and charts of the results.

*PASS* is accurate. It has been extensively verified using books and reference articles. Proof of the accuracy of each procedure is included in the extensive documentation.

**PASS** is a standalone system. Although it is integrated with **NCSS**, you do not have to own **NCSS** to run it. You can use it with any statistical software you want.

#### Analysis of Variance

Factorial AOV Fixed Effects AOV Geisser-Greenhouse MANOVA\* Multiple Comparisons\* One-Way AOV Planned Comparisons Randomized Block AOV New Repeated Measures AOV\*

#### **Regression / Correlation**

Correlations (one or two) Cox Regression\* Logistic Regression Multiple Regression Poisson Regression\* Intraclass Correlation Linear Regression



**PASS** comes with two manuals that contain tutorials, examples, annotated output, references, formulas, verification, and complete instructions on each procedure. And, if you cannot find an answer in the manual, our free technical support staff (which includes a PhD statistician) is available.

#### **System Requirements**

**PASS** runs on Windows 95/98/ME/NT/ 2000/XP with at least 32 megs of RAM and 30 megs of hard disk space.

PASS sells for as little as \$449.95.

#### *PASS* Beats the Competition! No other program calculates sample sizes and power for as many different statistical procedures as does *PASS*. Specifying your input is easy, especially with the online help and manual.

**PASS** automatically displays charts and graphs along with numeric tables and text summaries in a portable format that is cut and paste compatible with all word processors so you can easily include the results in your proposal.

Choose *PASS*. It's more comprehensive, easier-to-use, accurate, and less expensive than any other sample size program on the market.

#### **Trial Copy Available**

You can try out *PASS* by downloading it from our website. This trial copy is good for 30 days. We are sure you will agree that it is the easiest and most comprehensive power analysis and sample size program available.

#### Proportions

Chi-Square Test Confidence Interval Equivalence of McNemar\* Equivalence of Proportions Fisher's Exact Test Group Sequential Proportions Matched Case-Control McNemar Test Odds Ratio Estimator One-Stage Designs\* Proportions – 1 or 2 Two Stage Designs (Simon's) Three-Stage Designs\*

#### **Miscellaneous Tests**

Exponential Means – 1 or 2\* ROC Curves – 1 or 2\* Variances – 1 or 2

#### T Tests

Cluster Randomization Confidence Intervals Equivalence T Tests Hotelling's T-Squared\* Group Sequential T Tests Mann-Whitney Test One-Sample T-Tests Paired T-Tests Standard Deviation Estimator Two-Sample T-Tests Wilcoxon Test

Survival Analysis Cox Regression\* Logrank Survival -Simple Logrank Survival - Advanced\* Group Sequential - Survival Post-Marketing Surveillance ROC Curves – 1 or 2\*

#### **Group Sequential Tests**

Alpha Spending Functions Lan-DeMets Approach Means Proportions Survival Curves

#### Equivalence

Means Proportions Correlated Proportions\*

#### **Miscellaneous Features**

Automatic Graphics Finite Population Corrections Solves for any parameter Text Summary Unequal N's

\*New in PASS 2002

NCSS Statistical Software • 329 North 1000 East • Kaysville, Utah 84037 Internet (download free demo version): http://www.ncss.com • Email: sales@ncss.com Toll Free: (800) 898-6109 • Tel: (801) 546-0445 • Fax: (801) 546-3907

#### PASS 2002 adds power analysis and sample size to your statistical toolbox

#### WHAT'S NEW IN PASS 2002?

Thirteen new procedures have been added to *PASS* as well as a new home-base window and a new Guide Me facility.

#### MANY NEW PROCEDURES

The new procedures include a new multifactor repeated measures program that includes multivariate tests, Cox proportional hazards regression, Poisson regression, MANOVA, equivalence testing when proportions are correlated, multiple comparisons, ROC curves, and Hotelling's T-squared.

#### TEXT STATEMENTS

The text output translates the numeric output into easy-to-understand sentences. These statements may be transferred directly into your grant proposals and reports.

#### GRAPHICS

The creation of charts and graphs is easy in *PASS*. These charts are easily transferred into other programs such as MS PowerPoint and MS Word.

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#### NEW USER'S GUIDE II

A new, 250-page manual describes each new procedure in detail. Each chapter contains explanations, formulas, examples, and accuracy verification.

The complete manual is stored in PDF format on the CD so that you can read and printout your own copy.

#### **GUIDE ME**

The new *Guide Me* facility makes it easy for first time users to enter parameter values. The program literally steps you through those options that are necessary for the sample size calculation.

#### NEW HOME BASE

A new home base window has been added just for PASS users. This window helps you select the appropriate program module.

#### COX REGRESSION

A new Cox regression procedure has been added to perform power analysis and sample size calculation for this important statistical technique.

#### **REPEATED MEASURES**

A new repeated-measures analysis module has been added that lets you analyze designs with up to three grouping factors and up to three repeated factors. The analysis includes both the univariate F test and three common multivariate tests including Wilks Lambda. **RECENT REVIEW** 

In a recent review, 17 of 19 reviewers selected *PASS* as the program they would recommend to their colleagues.

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- Antoine de Saint Exupery

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Item Response Theory Models for Unfolding



The new GGUM2004 software system estimates parameters in a family of item response theory (IRT) models that unfold polytomous responses to questionnaire items. These models assume that persons and items can be jointly represented as locations on a latent unidimensional continuum. A single-peaked, nonmonotonic response function is the key feature that distinguishes unfolding IRT models from traditional, "cumulative" IRT models. This response function suggests

that a higher item score is more likely to the extent that an individual is located close to a given item on the underlying continuum. Such single-peaked functions are appropriate in many situations including attitude measurement with Likert or Thurstone scales, and preference measurement with stimulus rating scales. This family of models can also be used to determine the locations of respondents in particular developmental processes that occur in stages.

The GGUM2004 system estimates item parameters using marginal maximum likelihood, and person parameters are estimated using an expected *a posteriori* (EAP) technique. The program allows for up to 100 items with 2-10 response categories per item, and up to 2000 respondents. GGUM2004 is compatible with computers running updated versions of Windows 98 SE, Windows 2000, and Windows XP. The software is accompanied by a detailed technical reference manual and a new Windows user's guide. *GGUM2004 is free* and can be downloaded from:

### http://www.education.umd.edu/EDMS/tutorials

#### GGUM2004 improves upon its predecessor (GGUM2000) in several important ways:

- It has a user-friendly graphical interface for running commands and displaying output.
- It offers real-time graphics that characterize the performance of a given model.
- It provides new item fit indices with desirable statistical characteristics.
- It allows for missing item responses assuming the data are missing at random.
- It allows the number of response categories to vary across items.
- It estimates model parameters more quickly.

Start putting the power of unfolding IRT models to work in your attitude and preference measurement endeavors. Download your free copy of GGUM2004 today!



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#### Are you spending a large percentage of your time dealing with data issues?

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## Numerical Recipes in Fortran from Cambridge University Press

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William H. Press, Saul A. Teukolsky, William T. Vetterling, and Brian P. Flannery

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-SIAM Review

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#### Numerical Recipes in Fortran 90

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*—From the Foreword by Michael Metcalf, one of Fortran 90's original designers and author of* FORTRAN 90 Explained

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