Practical Stats Newsletter for January 2015

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1. Upcoming 2015 Training

In-person courses:

A new course! Focused on the new permutation test procedures that replace t-tests and ANOVA. Come learn about the newest, extremely important methods for environmental statistics.

Permutation Tests
Aug. 24-25, 2014 $995 through Aug 9, $1095 after.
Altamonte Springs (Orlando area), Florida

Applied Environmental Statistics
Sept. 21-25, 2015 $1495 through Sept. 6, $1595 after.
Lynnwood (Seattle area), Washington

Online registration is coming within a week. Other 2015 classes will be announced on our Training page and in upcoming newsletters as they are set. To register and for more information on all of our courses and webinars, see our Training page at http://practicalstats.com/training/

Webinars:

* Statistics for Managers Monday March 30, 2015. 11:30-12:30 PM Eastern, Free
Why would my employees need to know more than that one-semester course they took 5 to 10 years ago in college? Think about what's changed over the last 10 years – tablets, ease of access to wi-fi, Facebook and Twitter…… Statistics has changed a lot as well. We'll hit the high points of

flexible tests with few requirements (no more "must have a normal distribution"),
free comprehensive statistics software,
new and better methods of finding the best regression line,
why "has there been a change in concentration?" has very little to do with a mean,
and much more.

* Permutation Tests: Never Worry About a Normal Distribution Again!
Monday June 22, 2015. 11:30-1:00 PM Eastern, $250
A new webinar! Introduction to the new permutation test procedures that replace t-tests and ANOVA. See the benefits of the newest, extremely important methods for

environmental statistics. (Our two-day class on permutation tests, above, will provide much more detail and examples computed by students in class.)

2. Availability of Trend Test Software

Trend tests determine whether the mean or median is shifting over time – are values getting generally higher or lower? We cover a variety of these methods, testing shifts in both mean and median (typical) values in our Applied Environmental Statistics course, above. Regression methods are used to model changes in the mean, so any software containing multiple regression methods can be used for testing trends in the mean. Testing trends in the median concentration are based on Kendall's tau correlation coefficient, along with the Sen estimate of slope. The table below lists current software containing one or more of 5 variants of Kendall's tau based trend tests.

	MK	SK	SK+exog	SK+serialcorr	partial MK/SK
Minitab	x				
Applied Env Stats	x	x	x		
Kendall (USGS)	x	x	x	x	
R: rkt package	x	x		x	x
R: wq package	x	x			
R: EnvStats package	x	x		x	

Looking at the columns of this table, MK is the Mann-Kendall test for trend (Helsel and Hirsch, 2002). The test itself is simply the test for whether Kendall's tau correlation coefficient is significant, applied to an explanatory variable that is time. Any software that computes Kendall's tau performs this test, but MK software usually also reports the Sen slope and an estimate of intercept as well. This is often the only test available in commercial statistics software. SK is the Seasonal Kendall test for trend (Hirsch et al., 1982). The SK test can be performed after adjusting for an exogenous variable, a nonparametric analogue to multiple regression (Helsel and Hirsch, 2002). Hirsch et al. (1984) adjusted the SK test for the effect of serial correlation, the cross-correlation between seasons. They stated that because of the loss of power when performing the adjustment, it should be applied only when there are ten years of record or more. The final column in the table is the partial Mann-Kendall/Seasonal-Kendall test for trend (Libiseller and Grimvall, 2002), where the significance test is adjusted for an exogenous variable, but the equation for the trend is not modified, as it is for the previously-mentioned adjustment for exogenous variables, so its application is somewhat incomplete.

Minitab and other commercial software computes the Mann-Kendall test, either natively or as in the case of Minitab, with an add-on provided in their support/user-group online website. The US Geological Survey provides the free Kendall package in their Publications section online (http://pubs.er.usgs.gov/publication/sir20055275), a re-packaging in 2005 of the original 1980s Seasonal Kendall code. The software itself is available as Kendall.exe through the "Companion file" link. The Applied Environmental Statistics software are Minitab and R routines provided to students of the Practical Stats course of the same name, and so are only available by taking the course. The three R packages listed (rkt, wq, and EnvStats) are freely available for the R statistical software

system. Other sources for routines to run these methods have been available over the years, including SAS and VisualBasic/Excel software. If you are interested, searches online will lead you to them.

The partial Mann-Kendall test was developed in Sweden and may be less familiar to North American scientists. It has one specific purpose, to adjust the trend test significance level for the effect of a non-time covariate affecting the variable being tested for trend. However, it does not modify the trend equation itself for that covariate effect, while the adjustment for exogenous variables (often using LOWESS) does make that adjustment in slope and intercept of the trend equation. In our opinion that makes the exogenous variable adjustment more applicable for use in environmental studies than the partial test process found in the rkt package.

References:

Helsel and Hirsch (2002). Statistical Methods in Water Resources. *USGS Techniques of Water Resources Investigations, Book 4, Chapter A3*, 510 p.

Hirsch, Slack and Smith (1982). Techniques of trend analysis for monthly water quality data. Water Resour. Res., 18, 107-121.

Hirsch and Slack (1984). A nonparametric trend test for seasonal data with serial dependence. Water Resour. Res., 20, 727-732.

Libiseller and Grimvall (2002). Performance of partial Mann-Kendall tests for trend detection in the presence of covariates. Environmetrics 13, 71-84.

3. New software for Minitab 17 available for download

Minitab 17 changed several commands from previous versions, requiring changes to existing macros to work with version 17. New versions of Minitab macros for data with nondetects (censored data) written by Dennis Helsel, the NADA for Mtb package (version 4.0, for Minitab 17), is now at our download site:
http://practicalstats.com/downloads/

If you have taken our Applied Environmental Statistics course using Minitab (we also teach it using R), the version 17 macros (including trend analysis, regression diagnostics and permutation procedures, among others) from the class are available at no charge to past students by emailing us. Make sure to include the date and location of the course you attended, and we'll send the newest version of the Mintab macros to you.

'Til next time,

Practical Stats
-- Make sense of your data