

Writing SAS Functions without SAS/TOOLKIT® (Formulas)

1-sided confidence limits [use (1-conf)/2 in place of 1-conf for 2-sided limits]

Binomial Confidence Limits (cf. Hahn & Meeker, p.104, also Daly)

LCL = BETAINV(1-conf,s,n-s), (0 if s=0)

UCL = BETAINV(conf,s+1,n-s), (0 if s=n)

Poisson Confidence Limits (cf. Hahn & Meeker, p.123, also Daly)

LCL = GAMINV(1-conf,x), (0 if x=0)

UCL = GAMINV(conf,x+1)

Normal SD confidence limits (cf. Hahn & Meeker, p.55)

LCL = s*SQRT(df/CINV(conf,df))

UCL = s*SQRT(df/CINV((1-conf),df))

Normal CV (aka RSD) confidence limits (presumes negative sample mean negligible) (cf. Lehman, p.352, #53)

LCL = SQRT(n/FNONCT(n/cv**2,1,df,1-conf))

UCL = SQRT(n/FNONCT(n/cv**2,1,df,conf))

Normal C_p confidence limits (cf. Chou *et al* also Kotz & Johnson)

LCL = cp*SQRT(CINV((1-conf),df)/df)

UCL = cp*SQRT(CINV(conf,df)/df)

Normal C_{pk} confidence limits for 1-sided specification (cf. Chou *et al* also Kotz & Johnson)

LCL = TNONCT(cp*3*SQRT(n),df,conf)/SQRT(n)/3

UCL = TNONCT(cp*3*SQRT(n),df,1-conf)/SQRT(n)/3

Other Applications

Distribution of r^{th} ordered observation from a sample of size n ($r=1$ is smallest observation)

(cf. David, formula 2.1.5)

PDF = PDF('BETA',probf(x<,args>),r,n+1-r)*PDF(dist,x<,args>)

CDF = PROBBETA(probf(x<,args>),r,n+1-r)

INV = invfn(BETAINV(p,r,n+1-r)<,args>)

e.g. PDF = PDF('BETA',PROBCHI(x,df<,nc>),r,n+1-r)*PDF('CHISQUARE',x,df<,nc>)

CDF = PROBBETA(PROBCHI(x,df<,nc>),r,n+1-r)

INV = CINV(BETAINV(p,r,n+1-r),df<,nc>)

cdf for Skellam distribution (difference between two Poisson counts ($y=x_1-x_2$) with rates L_1 and L_2)

(cf. Johnson, Kotz & Kemp, p. 191, also http://en.wikipedia.org/wiki/Skellam_distribution)

PDF = IBESSEL(-y,2*SQRT(L1*L2),0)*(L2/L1)**(-y/2)*exp(-L1-L2) (integer $y \leq 0$)

PDF = IBESSEL(y,2*SQRT(L1*L2),0)*(L1/L2)**(y/2)*exp(-L1-L2) (integer $y \geq 0$)

CDF = PROBCHI(2*L2,-2*y,2*L1) (integer $y < 0$)

CDF = 1-PROBCHI(2*L1,2*(y+1),2*L2) (integer $y \geq 0$)

1-sided Normal Tolerance factor to bound fraction p of population with specified confidence

($\bar{X} + k S$ or $\bar{X} - k S$) (cf. Odeh & Owen, also <http://www1.fpl.fs.fed.us/tolerance.html>)

$k = \text{TINV}(\text{conf}, \text{df}, \text{SQRT}(n) * \text{PROBIT}(p)) / \text{SQRT}(n)$

Distribution Free Tolerance interval (cf Hahn and Meeker p.91)

r^{th} ordered observation is distribution-free lower bound for p proportion of the population

$r = \text{QUANTILE}(\text{'BINOM'}, 1-\text{conf}, 1-p, n)$

References

Chou, Owen, & Borrego. 1990. "Lower confidence limits on process capability indices." *JQT* 22:223-229.

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