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Language : Fortran **Revised:**

Student's t-Distribution and Its Inverse

Function subprogram `STUDIS` calculates the value of the Student t-distribution function

$$F(t,n) \;=\; \frac{\Gamma(\frac{1}{2}(n+1))}{\sqrt{\pi n}\;\Gamma(\frac{1}{2}n)} \int_{-\infty}^{t} \left(1+\frac{x^2}{n}\right)^{-\frac{1}{2}(n+1)} dx$$

for a given degrees of freedom $n \geq 1$.
Function subprogram `STUDIN` calculates the inverse $t(F,n)$.

Structure:

`FUNCTION` subprogram
User Entry Names: `STUDIS`, `STUDIN`
Files Referenced: Printer
External References: `GAUSIN` (G105), `MTLMTR` (N002), `ABEND` (Z035)

Usage:

In any arithmetic expression,

`STUDIS(T,N)` or `STUDIN(F,N)` has the value $F(\mathtt{T},\mathtt{N})$ or $t(\mathtt{F},\mathtt{N})$,

respectively. `STUDIS`, `STUDIN`, `F` and `T` are of type `REAL`, `N` is of type `INTEGER`.

Error handling:

Error `G104.1`: `N` $\leq$ `0`.
Error `G104.2`: `F` $<$ `0` or `F` $>$ `1`.
In both cases, a message is written on `Unit 6`, unless subroutine `MTLSET` (N002) has been called.

Accuracy:

About six decimal places are usually correct. Accuracy is lost for `STUDIS` when `T` $<<$ `0` and `N` $>$ `4`.

Notes:

The subprograms are based on algorithms given in the references.

References:

1. B.E. Cooper, Algorithm AS3 - Applied Statistics **17** (1968) 189.
2. G.W. Hill, Algorithm 396, Student's t-quantiles, Collected algorithms from CACM (1970).

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