

NOTE K: NEW DISPLAY MODIFIED PROBABILITY DISTRIBUTIONS

Knusel has indicated a fixed point view for all p values, considering p values less than 0.00005 as zero and p values larger than 0.99995 as one. By selecting: Format → Cells → Number → Number → Decimal Places → 4 → OK, this position is put into place FOR THE SELECTED CELLS. The vba instruction is SelectionNumberFormat = "0.0000".

McCullough has taken the floating-point view in all of his recent articles on faults in Excel. In McCullough (2004b), when Excel returns a zero value instead of a small tail value, he considers this as an Excel fault. This implies that a selection sequence Format → Cells → Number → Scientific → Decimal Places → 6 → OK would put his view in place FOR THE SELECTED CELLS. The VBA instruction is SelectionNumberFormat = "0.000000E+00".

Megastat interprets the p value in terms of how it is to be displayed. P values below 1E-15 are displayed as zero. The subroutine that brings up the p displays, has lines of code that identify the range in which the data lies

1 to 0.0001,	SelectionNumberFormat = "0.0000".
0.0001 to 1E-15,	SelectionNumberFormat = "0.00E+00".
Less than 1E-15, p=0,	SelectionNumberFormat = "0.00E+00".

The ability to manage the number of displayed digits depends on the fact that the object cell (as a row and column identifier) is previously set (Output!\$B\$4 and Output!\$C\$4), so that the NumberFormat setting instruction and logic can be included in the subroutine.

The {DISP} object can in some circumstances be tailored to fit the {IF} object. "A general rule is that a User Defined Function entered on the worksheet cannot modify the Excel environment other than by returning a value. However use can be made of an existing function to modify the cell or range that the User Defined Function occupies." (Ivens and Carlberg 1999, p 530).

For example:

```
Function NewNormalProb(z As Double) As String
    Dim p1 As Double
    p1 = WorksheetFunction.NormSDist(z)
    NewNormalProb = Format(p1, "0.000000E+000")
End Function
```

Returns the following displayed values for the z values in the first column:

z	p
-1.2	1.150697E-001
-2.5	6.209665E-003
-3.6	1.591086E-004
-4.1	2.065751E-005

-5.8	3.315746E-009
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The p values are locked to 7 digits here in this case. When viewed as a 15 digit number, all the digits after the 7th would be zeros.

The output of the function is now a variant with the string property, having a fixed format. The contents of the cell however, are recognized as being numbers when involved in other computations. In the above example, the number is limited to the number of digits displayed. The user can no longer change the display, since it is a locked-in-string. However another cell containing $=1 * F1$, where F1 is one of the above function cells, will return a number that can be reformatted to whatever the user wants. Also, by writing an equation as $=1 * \text{NewNormalProb}(z)$, the return will be a number, which then can be formatted to the users criteria.

By changing the format code (see Help) different displays can be obtained. By using these other formats, and by adding If-THEN-ELSE statements, the displays of the values from the probability distribution functions can be set to:

- Fixed-Point (String)
- Floating-Point (String)
- Truncated-Floating-Point (String)
- Direct Function Output (Double) (the default)

By adding another input (e.g. an integer from 1 to 4) to the function, all the critics of Excel can be satisfied. Incorporating this would be a drastic change in the way Excel returns function values. By coding the function so that the default results if the display code were left out of the calling list, all previous Excel files would not have to be changed.

With the current Excel-2003 functions, Excel does not meet both Knusel and McCullough's requirements. The {DISP} object is not fixed internally to the accuracy of the {IF} value. Changing the functions to give a fixed display, still does not resolve the issues on just what this display should be. The problem of presetting the number of digits based on the values of the input parameters, currently is insurmountable for the multi-parameter input functions.