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1 1 '-----
2 2 'CHI-SQUARED ANALYSIS (CHSQMTBF.BAS)
3 3 '-----
4 8 CLS
5 9 Print
6 10 Print " CHI-SQUARED ANALYSIS TO DEMONSTRATE MTBF (CHSQMTBF.BAS) "
7 11 Print
8 12 Print " ORIGINAL DATE: Circa 1987"
9 14 Print " REVISION DATE: October 28, 2020"
10 16 Print " AUTHOR: Phil Rutherford (www.philrutherford.com) "
11 18 Print " RUN DATE: ";Date$;
12 19 Print " (DD-MM-YYYY)
13 20 Print " RUN TIME: ";TIME$
14 21 Print " RUN WITH MMBASIC.EXE (www.mmbasic.com) "
15 22 Print
16 24 Print " USING THE CHI-SQUARED DISTRIBUTION CALCULATE ..."
17 25 Print " PROBABILITY OF ACHIEVING AN OPERATING MTBF GOAL WITH 'NF' FAILURES IN A
TEST PERIOD OF T HOURS"
18 26 Print " PROBABILITY OF ACHIEVING A DEMAND MTBF GOAL WITH 'NF' FAILURES IN T TRIALS"
19 27 PRINT
20 28 Input " CHOOSE OPERATING (O) OR DEMAND (D) MTBF (O or D)";OD$: Print
21 29 If OD$ = "D" Then 133 Else 33
22 30 '-----
23 31 'OPERATING INPUT
24 32 '-----
25 33 Print " OPERATING 'MEAN TIME BETWEEN FAILURES' (MTBF) "
26 34 Print
27 37 Input " MTBF GOAL (HOURS) = ";MTBF
28 38 Print " FAILURE RATE GOAL (PER HOUR) = ";1/MTBF
29 39 Print
30 40 Input " TEST TIME (HOURS) = ";TTEST
31 50 Input " NO. OF FAILURES = ";NF
32 60 Print " DEGREES OF FREEDOM = ";2*(NF+1)
33 70 CHISQ=2*TTEST/MTBF
34 71 Print " CHISQ = ";CHISQ
35 73 Print
36 74 Goto 176
37 130 '-----
38 131 'DEMAND INPUT
39 132 '-----
40 133 Print " DEMAND 'MEAN DEMANDS BETWEEN FAILURES' (MTBF) "
41 134 Print
42 137 Input " MTBF GOAL (TRIALS) = ";MTBF
43 138 Print " FAILURE RATE GOAL (PER DEMAND) = ";1/MTBF
44 139 Print
45 140 Input " NO. OF TRIALS = ";TTEST
46 150 Input " NO. OF FAILURES = ";NF
47 160 Print " DEGREES OF FREEDOM = ";2*(NF+1)
48 170 CHISQ=2*TTEST/MTBF
49 171 Print " CHISQ = ";CHISQ
50 172 Print
51 173 '-----
52 174 ' CALCULATE PROBABILITIES
53 175 '-----
54 176 Dim FAC(1000)
55 178 Dim P(1000)
56 179 SUM=0
57 180 M=CHISQ/2
58 181 FAC(0)=1
59 182 MULT=3 ' MULTIPLE FACTOR FOR TEST FAILURES
60 183 ADD=5 ' ADDITIVE FACTOR FOR TEST FAILURES
61 184 XMAX=MULT*NF+ADD
62 185 For X=1 To XMAX
63 186 FAC(X)=FAC(X-1)*X
64 187 Next X
65 188 Print " PROBABILITY DENSITY FUNCTION (PDF)";TAB(41);"CUMULATIVE DENSITY FUNCTION

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(CDF) "
66 189 Print
67 190 For X=0 To XMAX
68 195 P(X)=(Exp(-TTEST/MTBF) * (TTEST/MTBF)^X) / FAC(X)
69 202 Print " Pr(";X;" FAILURES) =";P(X);
70 205 SUM=SUM+P(X)
71 206 Print TAB(41);"Pr(<=";X;" FAILURES) =";SUM
72 207 If X=NF Then SUMNF=SUM
73 208 CL=1-SUMNF
74 210 Next X
75 230 Print
76 235 If OD$ = "D" Then Goto 339 Else Goto 239
77 236 '-----
78 237 ' PRINT OPERATING SUMMARY
79 238 '-----
80 239 Print " PROBABILITY OF MEETING MTBF GOAL WITH";NF;" FAILURES IN";TTEST;" HOURS =";
81 240 Print CL;
82 241 Print TAB(84);"= Pr(MTBF =>";MTBF;)"
83 245 Print " PROBABILITY OF MISSING MTBF GOAL WITH";NF;" FAILURES IN";TTEST;" HOURS =";
84 246 Print 1-CL;
85 247 Print TAB(84);"= Pr(MTBF <";MTBF;)"
86 250 Print
87 252 Print " "NF;" FAILURES IN";TTEST;" HOURS DEMONSTRATES AN MTBF GOAL OF";MTBF;" HOURS
TO A CONFIDENCE LEVEL OF";CL*100;" %"
88 254 Goto 354
89 253 '-----
90 254 ' PRINT DEMAND SUMMARY
91 255 '-----
92 339 Print " PROBABILITY OF MEETING MTBF GOAL WITH";NF;" FAILURES IN";TTEST;" DEMANDS =";
93 340 Print CL;
94 341 Print TAB(86);"= Pr(MTBF =>";MTBF;)"
95 345 Print " PROBABILITY OF MISSING MTBF GOAL WITH";NF;" FAILURES IN";TTEST;" DEMANDS =";
96 346 Print 1-CL;
97 347 Print TAB(86);"= Pr(MTBF <";MTBF;)"
98 350 Print
99 352 Print " "NF;" FAILURES IN";TTEST;" DEMANDS DEMONSTRATES AN MTBF GOAL OF";MTBF;"
DEMANDS TO A CONFIDENCE LEVEL OF";CL*100;" %"
100 354 Print
101 2000 End

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