APPENDIX

With reference to example 3, Chapter 1, here is the verification that the structure defined in it is a multiple Boolean algebra of order 4.

The underlying set is, $F = \{t_0, t_1, t_2, t_3\}$. But here for verification we take that to be $\{0,1,2,3\}$. The verification is performed on computer. Here the distributivity and satisfication of De Morgan's laws are only checked. For the remaining properties, either the verification can be done easily from tables or it is simple to perform.

Firstly, the programme in BASIC is given for verification of distributivity. Then its out put is given. Programme for De Morgan's laws and its out put is given later.

Note. : The out put of 1st programme only shows that the operation $\overline{2}$ distributes over $\overline{3}$. Other cases can be easily done by making corresponding changes in line no. 420 of the programme. The statement

(a,b,c,) T

in the out put shows that

$$a \,\overline{2}\, (b \,\overline{3}\, c) = (a \,\overline{2}\, b) \,\overline{3}\, (a \,\overline{2}\, c)$$

where a,b,c F.

Similarly, the statement

$$(a,b) \qquad T$$

in the out put of programme 2 shows that

$$w (a \bar{O} b) = w(a) \bar{T} w(b)$$

Where w is the fundamental isomorphism.

(v in the original example is here denoted by w.

The change is done to avoid the confusion).

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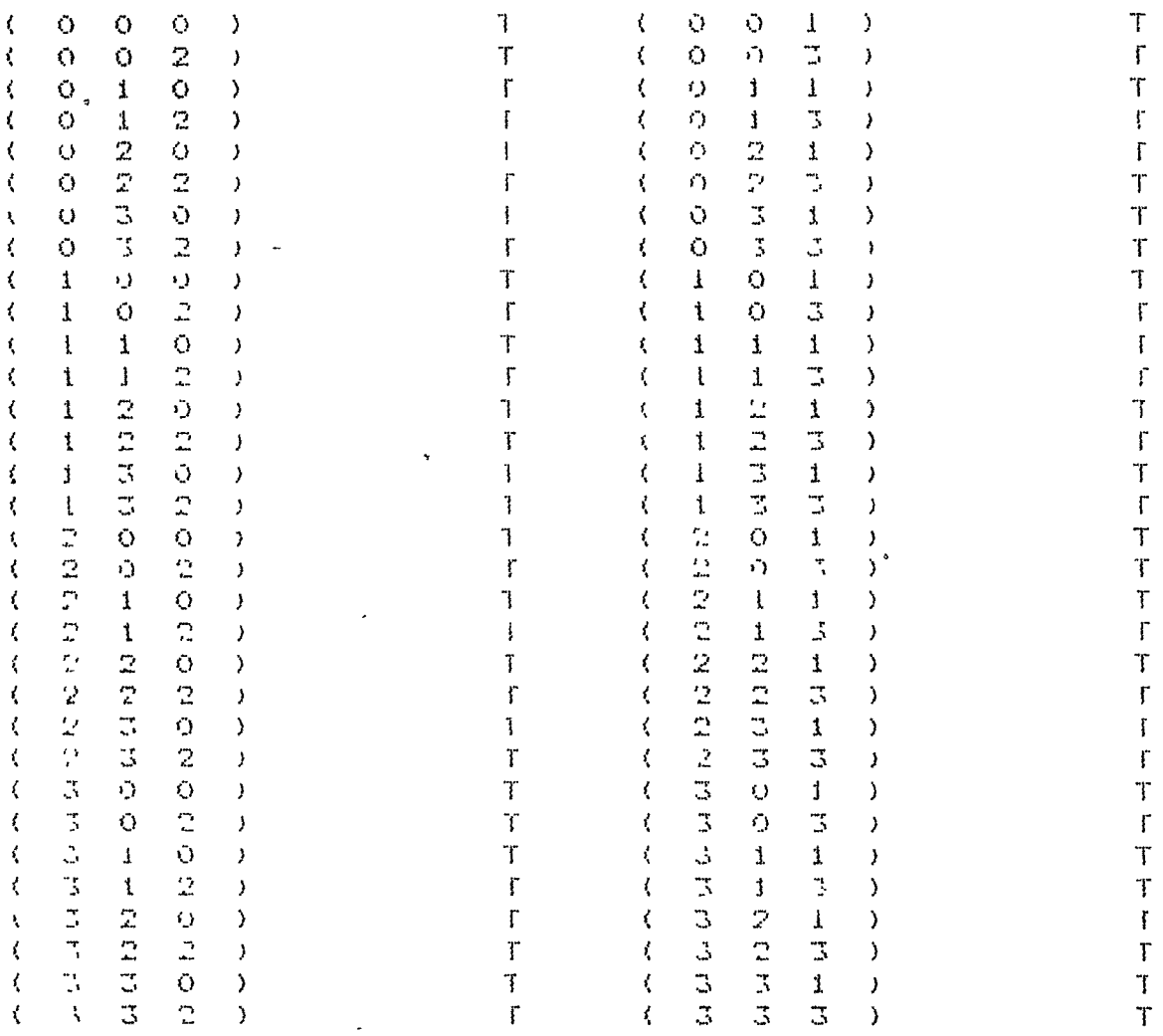
PROGRAMME FOR DISTRIBUTIVIY

```
10 DIM A(4,4) , B(4,4) , C(4,4) , D(4,4)
20 '*********************************
30 '*      A IS THE FUNCTION ZERO-BAR      *
40  *      B IS THE FUNCTION ONE-BAR       *
50 '*      C IS THE FUNCTION TWO-BAR       *
60 '*      D IS THE FUNCTION THREE-BAR     *
70 '*********************************
80 '
90 '              DATA FORR FUNCTION ZERO-BAR
100 '
110 LET           A(0,0) = 0 : A(0,1) = 2 : A(0,2) = 2 : A(0,3) = 0
120 LET           A(1,0) = 2 : A(1,1) = 1 : A(1,2) = 2 : A(1,3) = 1
130 LET           A(2,0) = 2 : A(2,1) = 2 : A(2,2) = 2 : A(2,3) = 2
140 LET           A(3,0) = 0 : A(3,1) = 1 : A(3,2) = 2 : A(3,3) = 3
150 '
160 '             DATA FOR FUNCTION ONE-BAR
170 '
180 LET           B(0,0) = 0 : B(0,1) = 1 : B(0,2) = 2 : B(0,3) = 3
190 LET           B(1,0) = 1 : B(1,1) = 1 : B(1,2) = 1 : B(1,3) = 1
200 LET           B(2,0) = 2 : B(2,1) = 1 : B(2,2) = 2 : B(2,3) = 1
210 LET           B(3,0) = 3 : B(3,1) = 1 : B(3,2) = 1 : B(3,3) = 3
220 '
230 '             DATA FOR FUNCTION TWO-BAR
240 '
250 LET           C(0,0) = 0 : C(0,1) = 3 : C(0,2) = 0 : C(0,3) = 3
260 LET           C(1,0) = 3 : C(1,1) = 1 : C(1,2) = 1 : C(1,3) = 3
270 LET           C(2,0) = 0 : C(2,1) = 1 : C(2,2) = 2 : C(2,3) = 3
280 LET           C(3,0) = 3 : C(3,1) = 3 : C(3,2) = 3 : C(3,3) = 3
290 '
300 '             DATA FOR FUNCTION THREE-BAR
310 '
320 LET           D(0,0) = 0 : D(0,1) = 0 : D(0,2) = 0 : D(0,3) = 0
330 LET           D(1,0) = 0 : D(1,1) = 1 : D(1,2) = 2 : D(1,3) = 3
340 LET           D(2,0) = 0 : D(2,1) = 2 : D(2,2) = 2 : D(2,3) = 0
350 LET           D(3,0) = 0 : D(3,1) = 3 : D(3,2) = 0 : D(3,3) = 3
360 '
370 '             CHECK FOR DISTRIBUTIVITY
380
390 FOR X = 0 TO 3
400 FOR Y = 0 TO 3
410 FOR Z = 0 TO 3
420 V1 = C(X,D(Y,Z))      :        V2 = D(C(X,Y),C(X,Z))
430 R$ = "T"
440 IF V1   V2 THEN R$ = "F"
450 PRINT "   ( ";X;Y;Z;" )",R$
460 IF R$ = "F" THEN STOP
470 NEXT Z
480 NEXT Y
490 NEXT X
500 END
```

OUT PUT



PROGRAMME FOR De MORGAN'S LAWS.

```
10 DIM A(4,4) , B(4,4) , C(4,4) , D(4,4)
20 '*************************************
30 '*      A IS THE FUNCTION ZERO-BAR     *
40 '*      B IS THE FUNCTION ONE-BAR      *
50 '*      C IS THE FUNCTION TWO BAR      *
60 '*      D IS THE FUNCTION THREE-BAR    *
70 '*************************************
80 '
90 '              DATA FORM FUNCTION ZERO-BAR
100 '
110 LET           A(0,0) = 0 : A(0,1) = 2 : A(0,2) = 2 : A(0,3) = 3
120 LET           A(1,0) = 2 : A(1,1) = 1 : A(1,2) = 2 : A(1,3) = 1
130 LET           A(2,0) = 2 : A(2,1) = 2 : A(2,2) = 2 : A(2,3) = 2
140 LET           A(3,0) = 0 : A(3,1) = 1 : A(3,2) = 2 : A(3,3) = 3
150 '
160 '             DATA FOR FUNCTION ONE-BAR
170 '
180 LET           B(0,0) = 0 : B(0,1) = 1 : B(0,2) = 2 : B(0,3) = 1
190 LET           B(1,0) = 1 : B(1,1) = 1 : B(1,2) = 1 : B(1,3) = 1
200 LET           B(2,0) = 2 : B(2,1) = 1 : B(2,2) = 2 : B(2,3) = 1
210 LET           B(3,0) = 3 : B(3,1) = 1 : B(3,2) = 1 : B(3,3) = 3
220 '
230 '             DATA FOR FUNCTION TWO-BAR
240 '
250 LET           C(0,0) = 0 : C(0,1) = 3 : C(0,2) = 0 : C(0,3) = 3
260 LET           C(1,0) = 3 : C(1,1) = 1 : C(1,2) = 1 : C(1,3) = 3
270 LET           C(2,0) = 0 : C(2,1) = 1 : C(2,2) = 2 : C(2,3) = 3
280 LET           C(3,0) = 3 : C(3,1) = 3 : C(3,2) = 3 : C(3,3) = 3
290 '
300 '             DATA FOR FUNCTION THREE-BAR
310
320 LET           D(0,0) = 0 : D(0,1) = 0 : D(0,2) = 0 : D(0,3) = 0
330 LET           D(1,0) = 0 : D(1,1) = 1 : D(1,2) = 2 : D(1,3) = 3
340 LET           D(2,0) = 0 : D(2,1) = 2 : D(2,2) = 2 : D(2,3) = 0
350 LET           D(3,0) = 0 : D(3,1) = 3 : D(3,2) = 0 : D(3,3) = 3
360 '
370 '             DATA FOR FUNCTION W
380 '
390 LET           W(0) = 2 : W(1) = 3 : W(2) = 1 : W(3) = 0
400 '
410 '             CHECK FOR DeMORGAN'S LAWS
420 '
430 FOR X = 0 TO 3
440 FOR Y = 0 TO 3
450 V1 = W(A(X,Y))      :        V2 = D(W(X),W(Y))
460 R$ = "T"
470 IF V1 <> V2 THEN R$ = "F"
480 PRINT "  ( ";X;Y;" )",R$
490 IF R$ = "F" THEN STOP
500 NEXT Y
510 NEXT X
550 END
```

OUT PUT.

(	0	0	)	T
(	0	1	)	[illegible]
(	0	2	)	T
(	0	3	)	F
(	1	0	)	T
(	1	1	)	T
(	1	2	)	T
(	1	3	)	T
(	2	0	)	T
(	2	1	)	F
(	2	2	)	T
(	2	3	)	F
(	3	0	)	T
(	3	1	)	F
(	3	2	)	T
(	3	3	)	F