IBM

Programmed Instruction Course

FORTRAN IV for IBM System/360

Illustrations

Education Development — *Endicott, New York*

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FORTRAN IV for IBM System/360

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Form X28-7327-4
Printed in U.S.A.

FORTRAN CODING FORM

		Punching Instructions		Page of
Program		Graphic	Card Form # *	Identification
Programmer	Date	Punch		73 80

C FOR COMMENT

STATEMENT NUMBER (1–5)	Cont. (6)	FORTRAN STATEMENT (7–72)
		IF (X) 40, 30, 30
40		X = -X
30		ROOT = X**0.5

* A standard card form, IBM electro 888157, is available for punching source statements from this form.

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Form X28-7327-4
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FORTRAN CODING FORM

Program		Punching Instructions: Graphic / Punch	Page of
Programmer	Date	Card Form # *	Identification (73–80)

C FOR COMMENT

STATEMENT NUMBER (1–5)	Cont. (6)	FORTRAN STATEMENT (7–72)
		IF(N)40,30,10
10		NFACT=1
		I=N
20		NFACT=NFACT*I
		I=I-1
		IF(I)40,40,20
30		NFACT=1 (by mathematical definition, zero factorial equals one)
40		(continue on in the program)

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FORTRAN CODING FORM

		Punching Instructions		Page of
Program		Graphic	Card Form # *	Identification
Programmer	Date	Punch		73 80

C FOR COMMENT

STATEMENT NUMBER (1–5)	Cont. (6)	FORTRAN STATEMENT (7–72)
		SUM=FIRST
		I=1
10		FIRST=FIRST+DIF
		SUM=SUM+FIRST
		I=I+1
		IF (I-NUM) 10,20,20
20		(continue on in the program)

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FORTRAN CODING FORM

Program		Punching Instructions		Page of
Program		Graphic	Card Form # *	Identification
Programmer	Date	Punch		73 80

C FOR COMMENT

STATEMENT NUMBER (1–5) | Cont. (6) | FORTRAN STATEMENT (7–72)

```
      IF (X-Y) 1Ø,2Ø,3Ø
         :
 1Ø
    (some statement or sequence of statements)
         :
      GO TO 4Ø
 2Ø      :
    (some statement or sequence of statements)
         :
      GO TO 4Ø
 3Ø      :
    (some statement or sequence of statements)
         :
 4Ø (continue on in the program)
         :
         :
```

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FORTRAN CODING FORM

		Punching Instructions		Page of
Program		Graphic	Card Form # *	Identification
Programmer	Date	Punch		73 80

C FOR COMMENT

STATEMENT NUMBER 1 5	Cont. 6	FORTRAN STATEMENT 7 10 15 20 25 30 35 40 45 50 55 60 65 70 72
		SUM=Ø.Ø
		DO 1Ø I=1,5Ø
1Ø		SUM=SUM+A(I)

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FORTRAN CODING FORM

Program		Punching Instructions		Page of
Programmer	Date	Graphic / Punch	Card Form # *	Identification (73–80)

C FOR COMMENT

STATEMENT NUMBER (1–5)	Cont. (6)	FORTRAN STATEMENT (7–72)
		BIGA=A(1)
10		DO 50 I=2,1000
20		IF (A(I)-BIGA) 50,50,30
30		BIGA=A(I)
50		CONTINUE

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FORTRAN CODING FORM

		Punching Instructions			Page of
Program		Graphic		Card Form # *	Identification
Programmer	Date	Punch			73 80

C FOR COMMENT

STATEMENT NUMBER (1–5)	Cont (6)	FORTRAN STATEMENT (7–72)
		DO 10 I=1,2000
		IF (BLOCK(I)) 10,20,10
10		CONTINUE
11		LOC = 0
		GO TO 21
20		LOC = I
21		(continue on in the program)

NOTE: Brackets will be used in future sample program segments to outline DO-loops, as done in this frame, for clarification purposes.

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FORTRAN CODING FORM

		Punching Instructions			Page of
Program		Graphic		Card Form # *	Identification
Programmer	Date	Punch			73 80

C FOR COMMENT

STATEMENT NUMBER (1–5)	Cont. (6)	FORTRAN STATEMENT (7–72)
		DO 10 I=1,10
		DO 10 J=1,10
		IF (A(I)-B(J)) 10,20,10
10		CONTINUE
		GO TO 30
20		LOC(1)=I
		LOC(2)=J
30		(continue on in the program)
		:

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FORTRAN CODING FORM

Program	Punching Instructions: Graphic / Punch	Card Form # *	Page of
Programmer / Date			Identification (73–80)

C FOR COMMENT

STATEMENT NUMBER (1–5)	Cont. (6)	FORTRAN STATEMENT (7–72)
		DO 1ØØ I=1,N
		K=N-I
		DO 1ØØ J=1,K
		IF (ARRAY(J)-ARRAY(J+1)) 1ØØ,1ØØ,1Ø
1Ø		TEMP=ARRAY(J)
		ARRAY(J)=ARRAY(J+1)
		ARRAY(J+1)=TEMP
1ØØ		CONTINUE
		NOTE: IF THE FIRST LINE OF CODING WERE CHANGED TO TWO LINES,
		M=N-1
		DO 1ØØ I=1,N
		ONE ITERATION IS ELIMINATED

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FORTRAN CODING FORM

	Punching Instructions		Page of
Program	Graphic	Card Form # *	Identification
Programmer / Date	Punch		73 80

C FOR COMMENT

STATEMENT NUMBER (1–5)	Cont. (6)	FORTRAN STATEMENT (7–72)
		K=X+1.Ø
		GO TO (1,2,3,4,5,6,7,8,9,1Ø,1Ø),K

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FORTRAN CODING FORM

		Punching Instructions		Page of
Program		Graphic	Card Form # *	Identification 73 80
Programmer	Date	Punch		

C FOR COMMENT

STATEMENT NUMBER 1 5	Cont. 6	FORTRAN STATEMENT 7 10 15 20 25 30 35 40 45 50 55 60 65 70 72
		A=3.Ø
		B=2.5
		C=1.Ø
4Ø		Y=A*X**2+B*X+C

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FORTRAN CODING FORM

	Punching Instructions		Page of
Program	Graphic	Card Form # *	Identification
Programmer / Date	Punch		73 80

C FOR COMMENT

STATEMENT NUMBER 1 5	Cont. 6	FORTRAN STATEMENT 7 10 15 20 25 30 35 40 45 50 55 60 65 70 72
4		DO 5 I=1,1Ø
5		READ(2,1)A(I)

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FORTRAN CODING FORM

Program		Punching Instructions		Page of
Programmer	Date	Graphic / Punch	Card Form # *	Identification 73–80

C FOR COMMENT

STATEMENT NUMBER (1–5)	Cont. (6)	FORTRAN STATEMENT (7–72)
		<u>Example 1</u>
		READ(2,1)K,A(K)
		<u>Example 2</u>
		DO 1Ø I=1,4
1Ø		READ(2,1)A(I)

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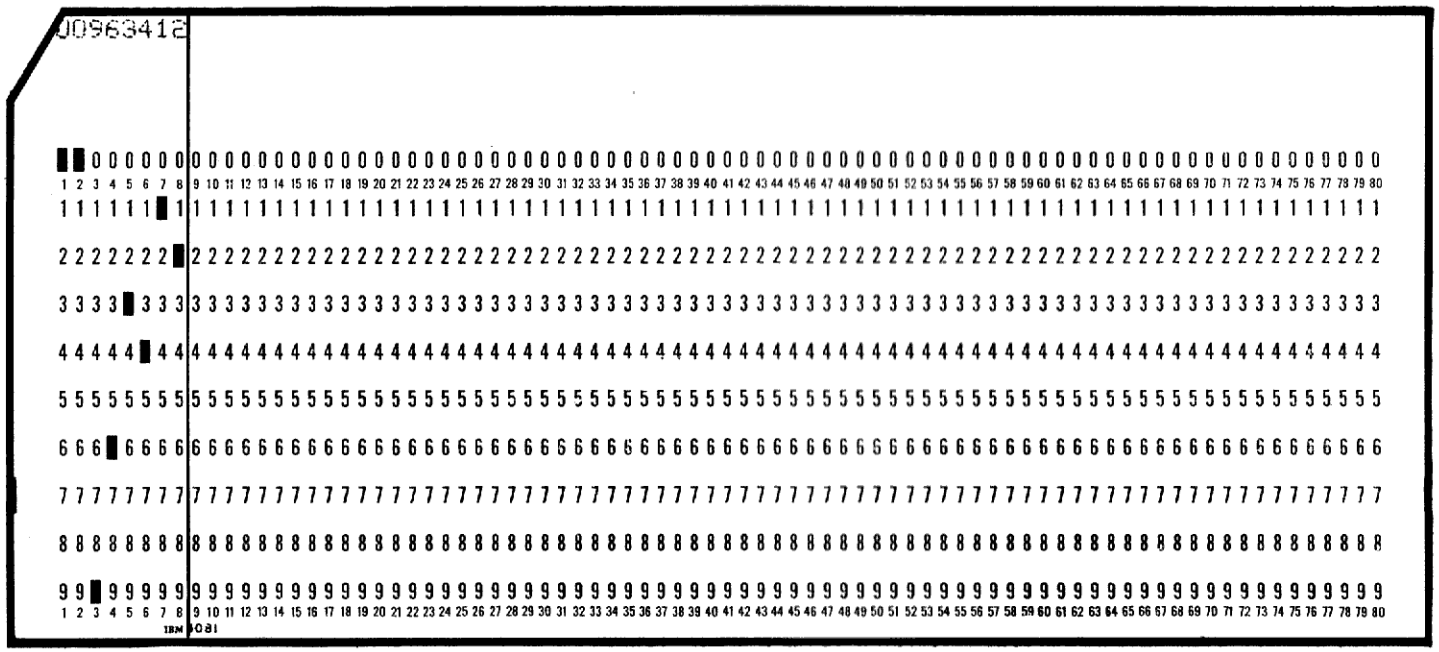
FORTRAN CODING FORM

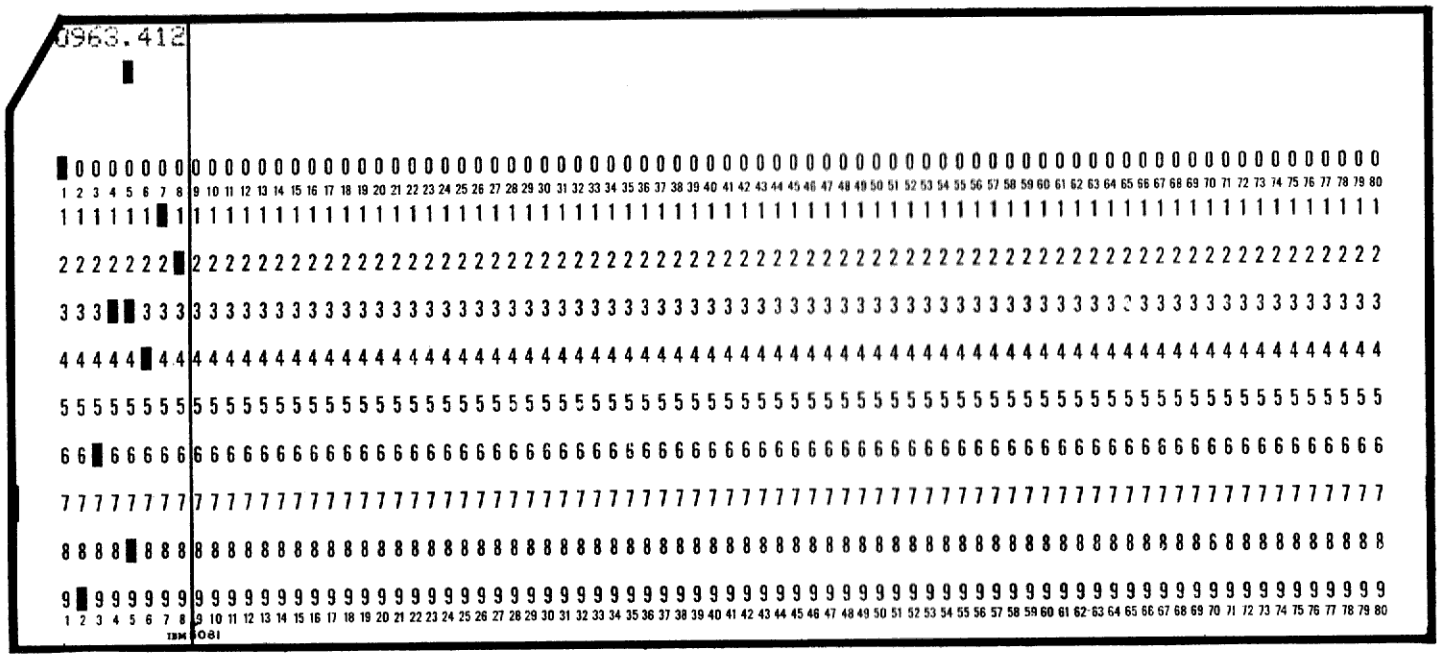
		Punching Instructions		Page of
Program		Graphic	Card Form # *	Identification
Programmer	Date	Punch		73 80

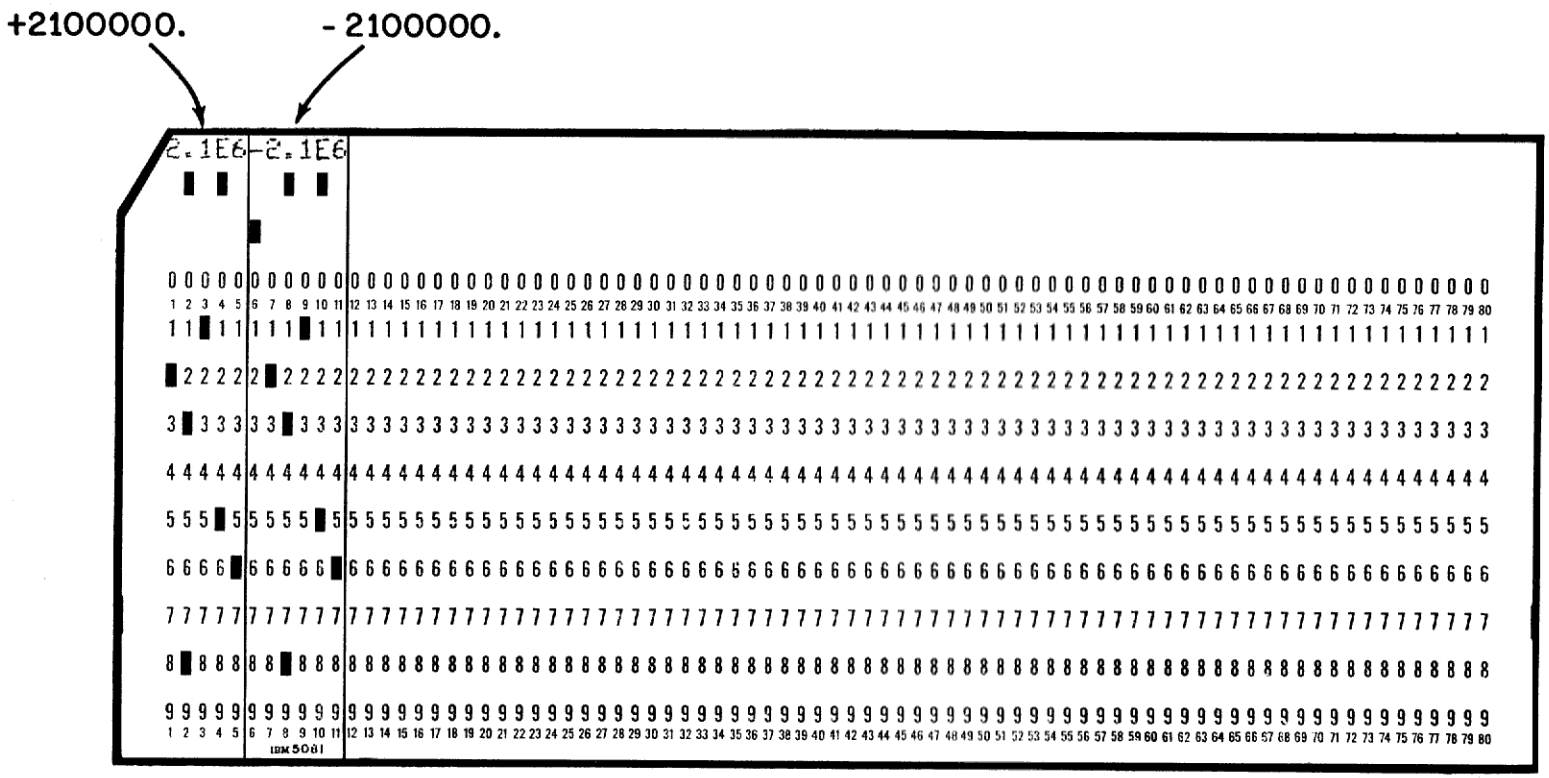
C FOR COMMENT

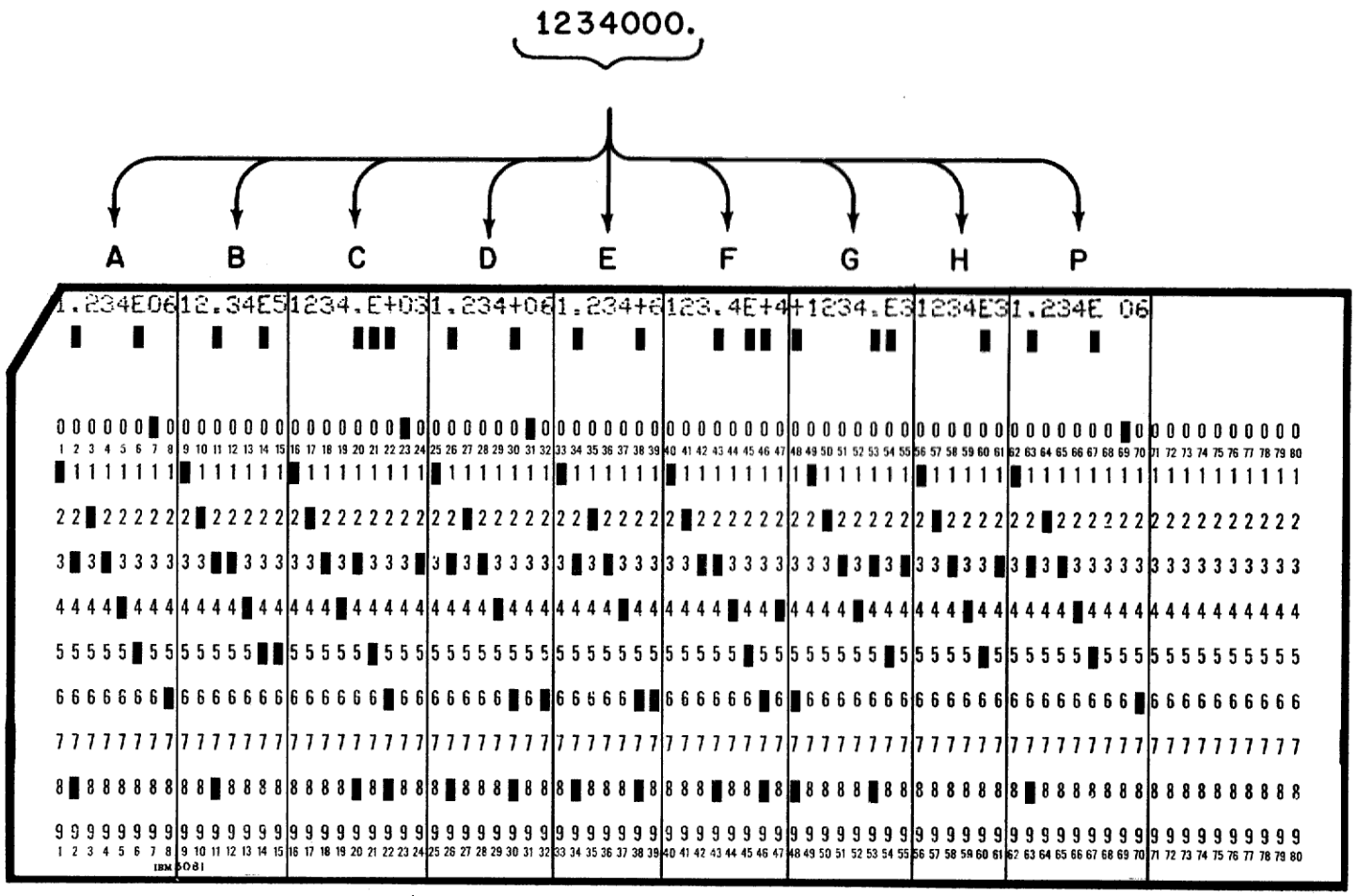
STATEMENT NUMBER 1 5	CONTINUE 6	FORTRAN STATEMENT 7 10 15 20 25 30 35 40 45 50 55 60 65 70 72
		READ(2,1)N
		DO 5 I=1,N
5		READ(2,2)A(I)

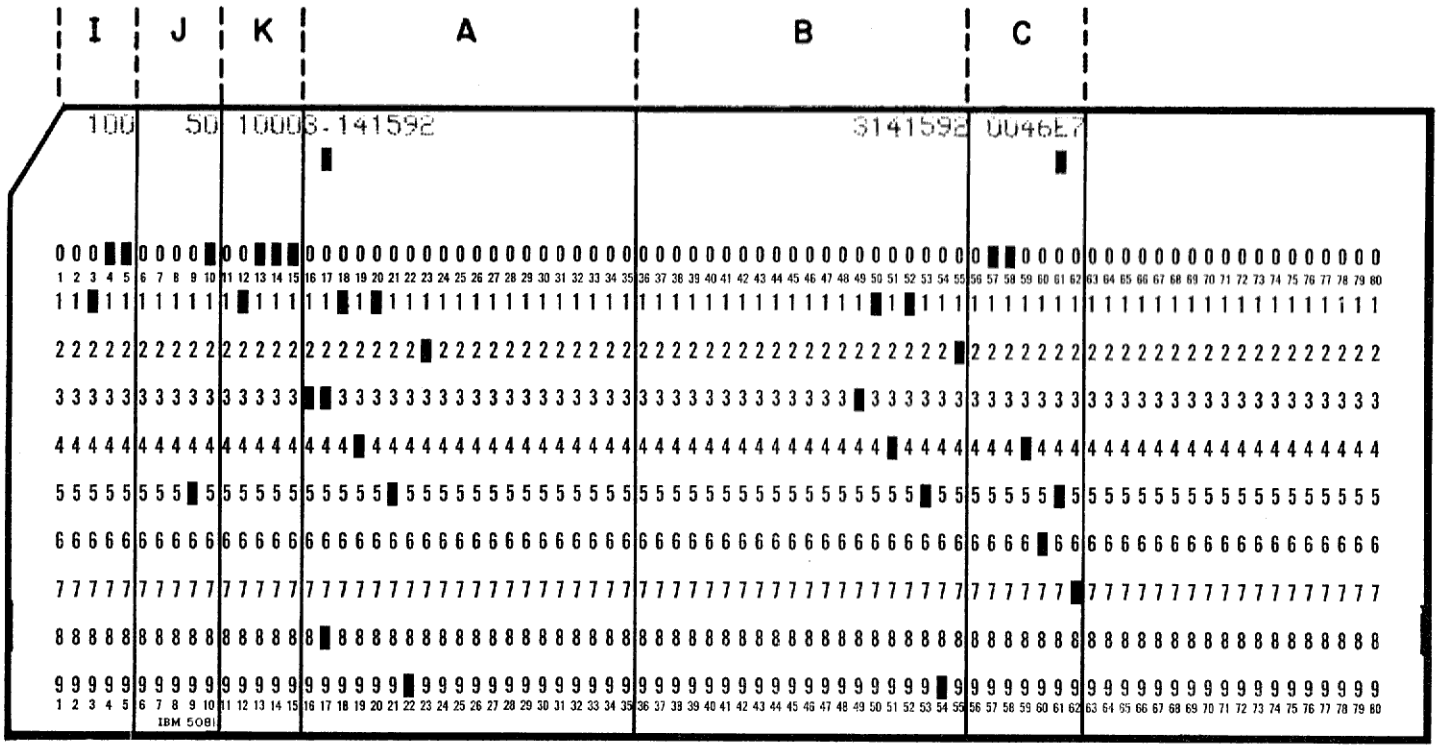
* A standard card form, IBM electro 888157, is available for punching source statements from this form.


00963412
IBM 3081


0963.412
IBM 6081


+2100000.
-2100000.
2.1E6
-2.1E6
IBM 5081


1234000.
A
B
C
D
E
F
G
H
P
1.234E06
12.34E5
1234.E+03
1.234+06
1.234+6
123.4E+4
+1234.E3
1234E3
1.234E 06
IBM 3081


I
J
K
A
B
C
100
50
10003-141592
3141592
0046E7
IBM 5081

F CONVERSION (using 4F10.4)

	VALUES IN STORAGE
X(1)	968.2319
X(2)	45.62
X(3)	-234.11
X(4)	42.
X(5)	1.45678
X(6)	-123.9601
X(7)	1234567.
X(8)	-.2
X(9)	-84566.12
X(10)	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•
•	•
X(20)	•

Printed (b = Blank)

X(1)	X(2)	X(3)	X(4)
bb968.2319	bbb45.6200	b-234.1100	bbb42.0000
bbbb1.4567	b-123.9601	**********	bbb-0.2000
84566.1200	REMAINING NUMBERS PRINTED		

X(9)	X(10)	X(11)	X(12)

X(13)	X(14)	X(15)	X(16)

X(17)	X(18)	X(19)	X(20)

VALUE IN STORAGE	E CODE	PRINTED
123.46	E12.5	b0.12346Eb03

E CONVERSION (using 3E20.7)

Printed (b = Blank)

	VALUES IN STORAGE
ALPHA(1)	968.2319
ALPHA(2)	-234.11
ALPHA(3)	.00000000004
ALPHA(4)	-.002
ALPHA(5)	1234567.
ALPHA(6)	-84566.12

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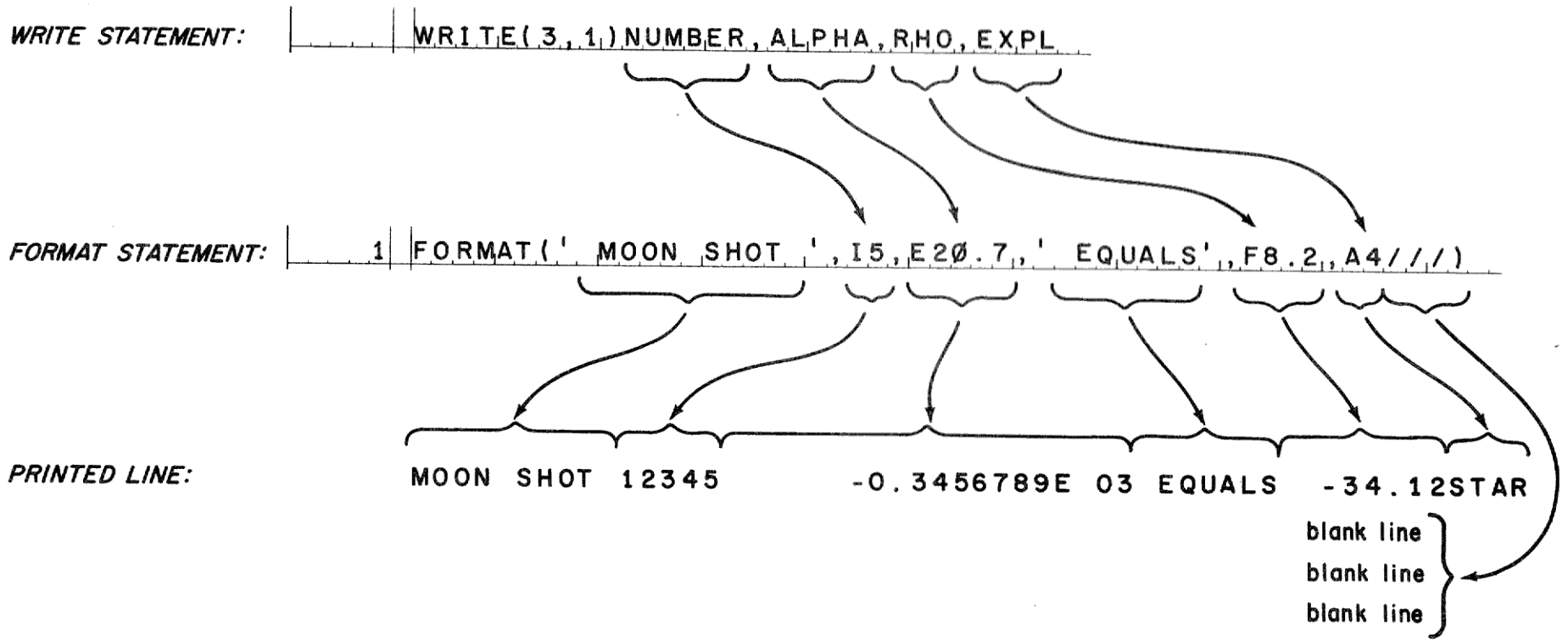
Programmer	Date	Punch		73 80

C FOR COMMENT

STATEMENT NUMBER 1 5	Cont. 6	FORTRAN STATEMENT 7 10 15 20 25 30 35 40 45 50 55 60 65 70 72
		WRITE(3,1)(A(I),I=1,1ØØØ)
1		FORMAT(' A ARRAY'//(1ØF12.4))

* A standard card form, IBM electro 888157, is available for punching source statements from this form.


WRITE STATEMENT:
WRITE(3,1)NUMBER,ALPHA,RHO,EXPL
FORMAT STATEMENT:
1 FORMAT(' MOON SHOT ',I5,E20.7,' EQUALS',F8.2,A4///)
PRINTED LINE:
MOON SHOT 12345 -0.3456789E 03 EQUALS -34.12STAR
blank line
blank line
blank line

LIBRARY FUNCTIONS AVAILABLE WITH S/360 FORTRAN SYSTEMS

Name	Purpose		Comments	Mode of Function	Mode of Argument	Examples
SIN(A)	Trigonometric sine	(sinA)	arg. in radians	real	real	Y = SIN(A+B)
COS(A)	Trigonometric cosine	(cosA)	arg. in radians	real	real	X = A+COS(Z)
TANH(A)	Hyperbolic tangent	(tanhA)	arg. in radians	real	real	C = TANH(X **2)
ATAN(A)	Arc-tangent	($\tan^{-1}A$)		real	real	RIN = OMEGA-ATAN(BETA)
SQRT(A)	Square root	($\sqrt{A}$)	argument ≥ 0	real	real	HYPOT=SQRT (A**2+B**2)
EXP(A)	Exponential	(e^A)		real	real	GAMMA=EXP(Y)
ALOG(A)	Natural logarithm	($\log_e A$)	argument > 0	real	real	Q = SIN(F)+ ALOG(5.0)
ALOG10(A)	Common logarithm	($\log_{10} A$)	argument > 0	real	real	S=ALOG10 (3.1416)

NOTE: Each function above has a double precision counterpart which performs the same operations for double precision arguments. See Reference Manual C28-6513 for details.

Name	Mode of Function	Mode of Arguments	Example
AMAX1	Real	Real	AMAX1(A,B,C)
MAX1	Integer	Real	MAX1(A, B,C)
AMAXO	Real	Integer	AMAXO(I, J, K)
MAXO	Integer	Integer	MAXO(I,J,K)

Name	Mode of Function	Mode of Arguments	Example
AMIN1	Real	Real	AMIN1(A,B,C)
MIN1	Integer	Real	MIN1(A,B,C)
AMINO	Real	Integer	AMINO(I,J,K)
MINO	Integer	Integer	MINO(I,J,K)

ADDITIONAL LIBRARY FUNCTIONS AVAILABLE WITH S/360 FORTRAN SYSTEMS

Name	Mode of Function	Mode of Arguments	No. of Arguments	Example
(Absolute value function)				
ABS	Real	Real	1	ABS(X**2-1.0)
IABS	Integer	Integer	1	IABS(I-L)
(Maximum value function)				
AMAX1	Real	Real	2 or more	AMAX1(X,Y,Z)
MAX1	Integer	Real	2 or more	MAX1(A(I),B,2.)
AMAXO	Real	Integer	2 or more	AMAXO(N(K),L,M)
MAXO	Integer	Integer	2 or more	MAXO(MI,LA)
(Minimum value function)				
AMIN1	Real	Real	2 or more	AMIN1(X,Y,Z)
MIN1	Integer	Real	2 or more	MIN1(A(I),B,2.)
AMINO	Real	Integer	2 or more	AMINO(N(K),L,M)
MINO	Integer	Integer	2 or more	MINO(MI,LA)
(Mode conversion and truncation functions)				
FLOAT	Real	Integer	1	FLOAT(INDEX)
IFIX	Integer	Real	1	IFIX(ALPHA)
AINT	Real	Real	1	AINT(VALUE)
INT	Integer	Real	1	INT(ALPHA)
(Modulo(remaindering) function)				
AMOD	Real	Real	2	AMOD(X,2.0)
MOD	Integer	Integer	2	MOD(K,2)
(Sign and Diminishing Functions)				
SIGN	Real	Real	2	SIGN(A,B)
ISIGN	Integer	Integer	2	ISIGN(L,M)
DIM	Real	Real	2	DIM(W,Z)
IDIM	Integer	Integer	2	IDIM(K,KK)

NOTE: Each function above has a double precision counterpart which performs the same operations for double precision arguments. See Reference Manual C28-6513 for details.

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	Punching Instructions		Page of
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C FOR COMMENT

STATEMENT NUMBER (1–5)	Cont. (6)	FORTRAN STATEMENT (7–72)
		FUNCTION SUM(A,N)
		DIMENSION A(100)
		SUM=A(1)
		DO 10 I=2,N
10		SUM=SUM+A(I)
		RETURN
		END

* A standard card form, IBM electro 888157, is available for punching source statements from this form.

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	Punching Instructions		Page of
Program	Graphic	Card Form # *	Identification
Programmer / Date	Punch		73 80

C FOR COMMENT

STATEMENT NUMBER (1 5)	Cont. (6)	FORTRAN STATEMENT (7 72)
		FUNCTION SUM(A,N)
		DIMENSION A(10Ø)
		SUM=A(1)
		DO 1Ø I=2,N
1Ø		SUM=SUM+A(I)
		RETURN
		END

IBM

FORTRAN CODING

Program		Graphic
Programmer	Date	Punch

C FOR COMMENT

STATEMENT NUMBER (1 5)	Cont. (6)	FORTRAN ST (7 35)
		(some pertinent program statements)
		Y=SUM(BLOCK,KOUNT)
		(continuation of program)
		END

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Program		Punching Instructions	Page of
Programmer	Date	Graphic / Punch	Card Form # *
			Identification (73–80)

C FOR COMMENT

STATEMENT NUMBER (1–5)	Cont. (6)	FORTRAN STATEMENT (7–72)
		SUBROUTINE COPY (A,B,N)
		DIMENSION A(100),B(100)
		DO 10 I=1,N
10		B(I)=A(I)
		RETURN
		END

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FORTRAN CODING

Program		Graphic
Programmer	Date	Punch

C FOR COMMENT

STATEMENT NUMBER (1–5)	Cont. (6)	FORTRAN STAT (7–35)
		(some pertinent statements)
		CALL COPY (X,Y,K)
		(continue on)
		END

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FORTRAN CODING FORM

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Program		Punching Instructions: Graphic / Punch	Card Form # *	Page of
Programmer	Date			Identification (73–80)

C FOR COMMENT

STATEMENT NUMBER (1–5)	Cont. (6)	FORTRAN STATEMENT (7–72)
		DIMENSION A(100)
1		FORMAT(I5/(6F12.4))
2		FORMAT(10F12.4)
		READ(2,1)N,(A(I),I=1,N)
		CALL ORDER(A,N)
		WRITE(3,2)(A(I),I=1,N)
		STOP
		END

* A standard card form, IBM electro 888157, is available for punching s

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FORTRAN CODING

Program		Graphic
Programmer	Date	Punch

C FOR COMMENT

STATEMENT NUMBER (1–5)	Cont. (6)	FORTRAN STA (7–35)
		SUBROUTINE ORDER (A,N)
		DIMENSION A(100)
		K=N-1
		DO 10 I=1,K
		M=N-I
		DO 10 J=1,M
		IF (A(J+1)-A(J))5,10,10
5		TEMP=A(J)
		A(J)=A(J+1)
		A(J+1)=TEMP
10		CONTINUE
		RETURN
		END

SUBPROGRAMS

Subprogram Characteristics	Library or Built-In Functions	Arithmetic Statement Functions	FUNCTION Subprograms	SUBROUTINE Subprograms
How named	Pre-selected names	1-6 alphanumeric characters, first alph. (Same rules as variables)	Same rules as variables	Same rules as variables
Mode	Predefined by name (implicit)	Implicit in name or by Type statement	Implicit in name or by Type statement. Also INTEGER or REAL can precede FUNCTION name	Undefined-mode of results depends upon argument names
How many values returned to main program	One value returned	One value returned	One value returned	More than one value can be returned
How called	By name	By name	By name	By CALL statement. CALL supplies data for dummy variables in SUBROUTINE-may transmit constants, variables or expressions
How written or defined	Pre-written and stored in library	Single arithmetic statement defined within program in which it appears. Def. precedes 1st executable program statement	Independently written program contains many statements, has RETURN and END	Independently written program contains many statements, has RETURN and END
Arguments	Number and type predefined-depends upon routine	Non-subscripted variables	Has at least one. May be nonsubscripted variables, arrays or dummy names of SUBROUTINE or other FUNCTION programs	May have none. Or can be nonsubscripted variables, arrays or dummy names of FUNCTION subprograms or other SUBROUTINES

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FORTRAN CODING FORM

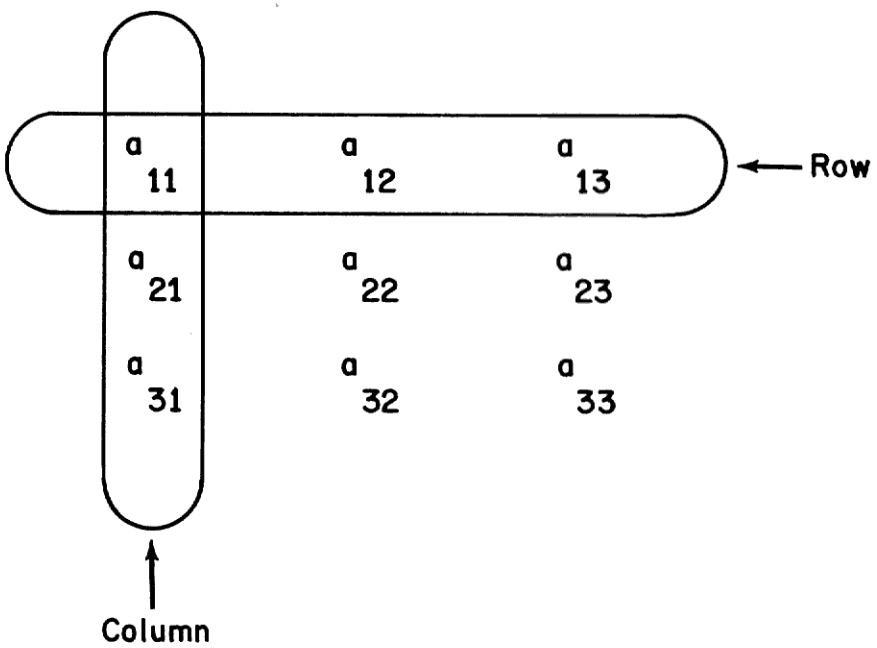
		Punching Instructions			Page of
Program		Graphic		Card Form # *	Identification
Programmer	Date	Punch			73 80

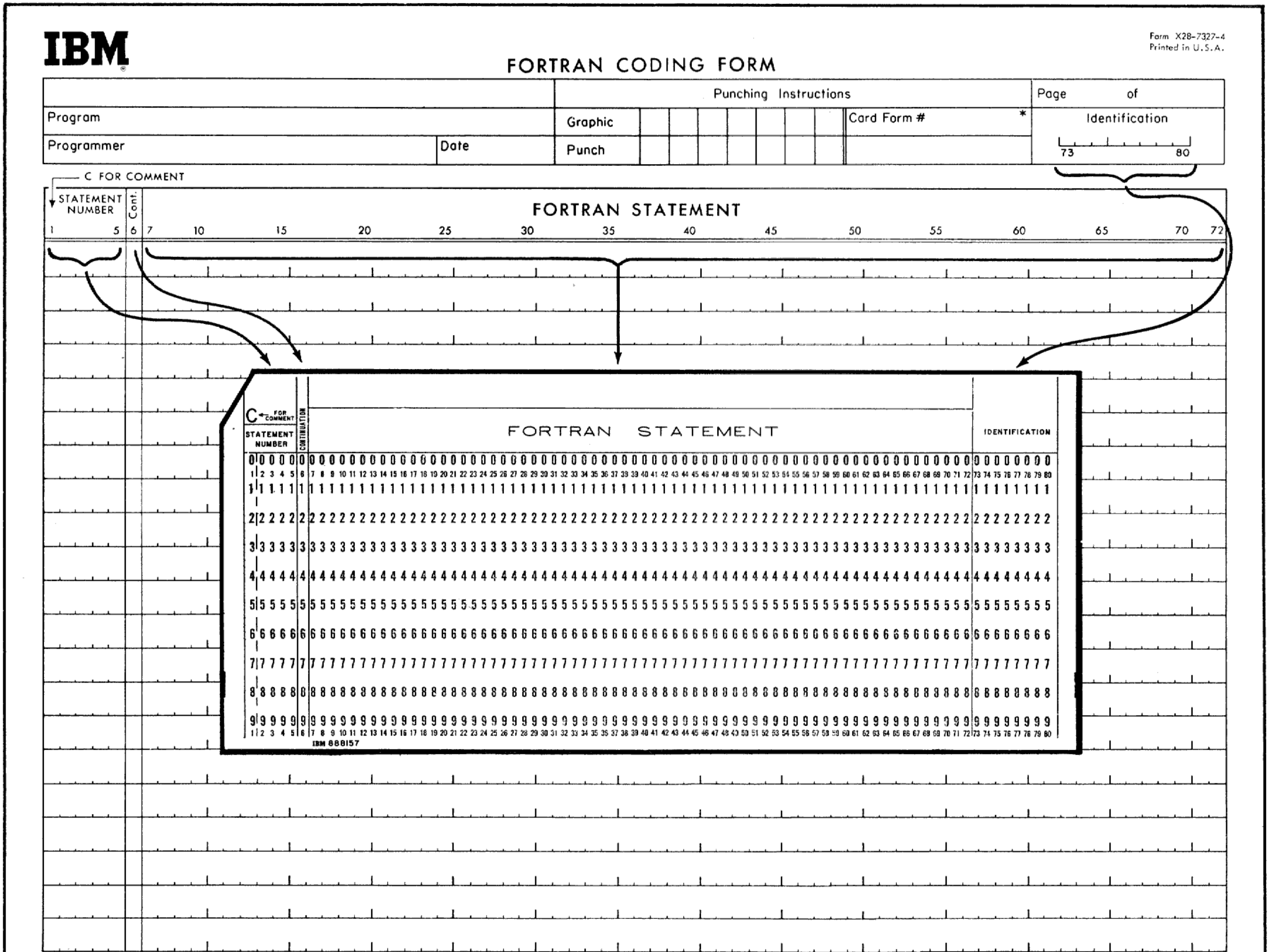
C FOR COMMENT

STATEMENT NUMBER 1 5	Cont. 6	FORTRAN STATEMENT 7 10 15 20 25 30 35 40 45 50 55 60 65 70 72
		~~
		~~ PREVIOUS CALCULATION DETERMINES
		~~ WHETHER TO TURN ON SENSE LIGHT 2
	OR	~~~
		CALL SLITE(2)
		~~
		~~ ADDITIONAL CALCULATIONS
		~~
		CALL SLITET(2,LINK)
		IF(LINK-1)10,20,10
20		ALPHA=SQRT(Y)
		GO TO 30
10		ALPHA=Y**3
30		continue program
		~~
		~~
		~~

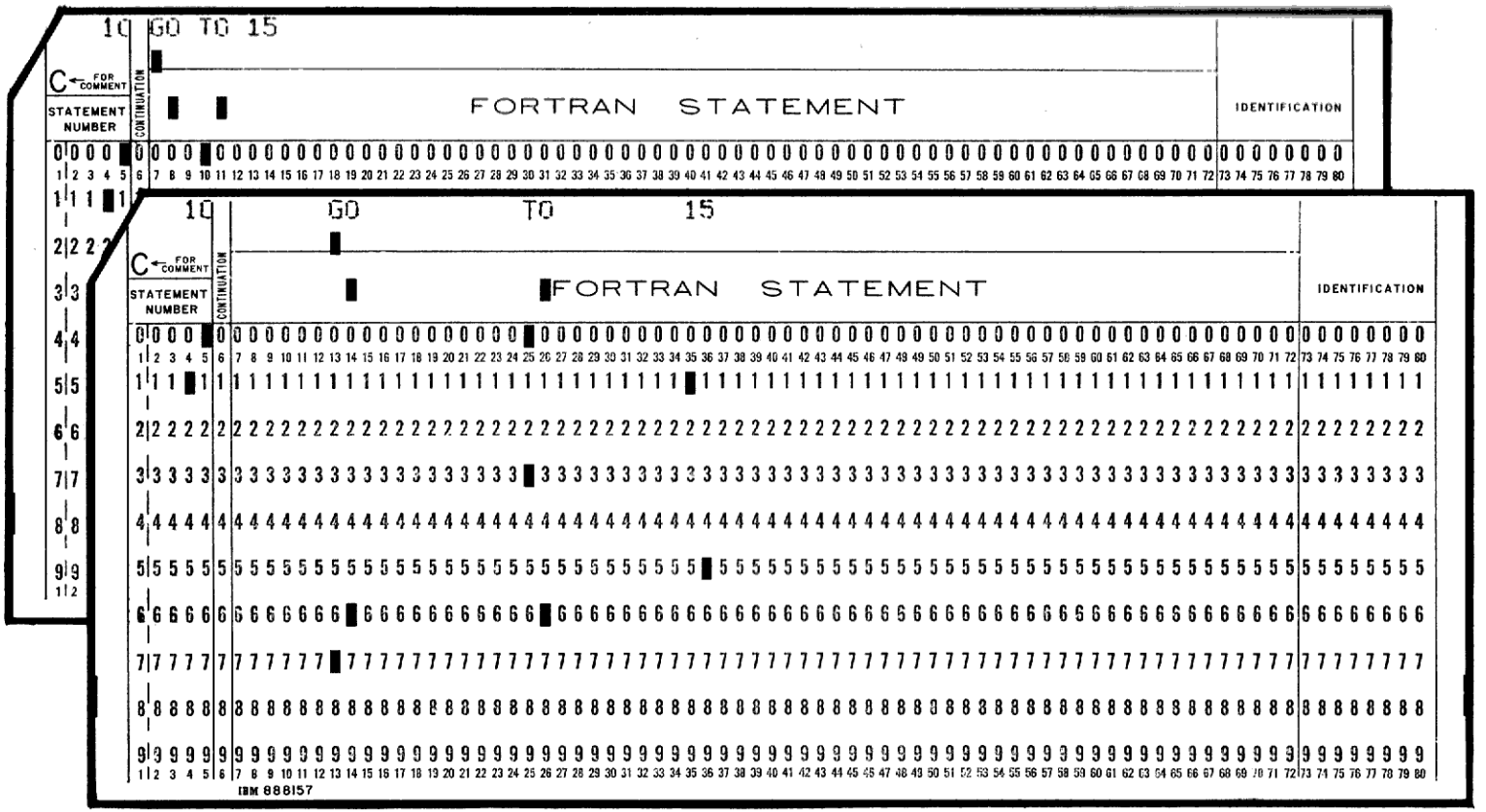
* A standard card form, IBM electro 888157, is available for punching source statements from this form.

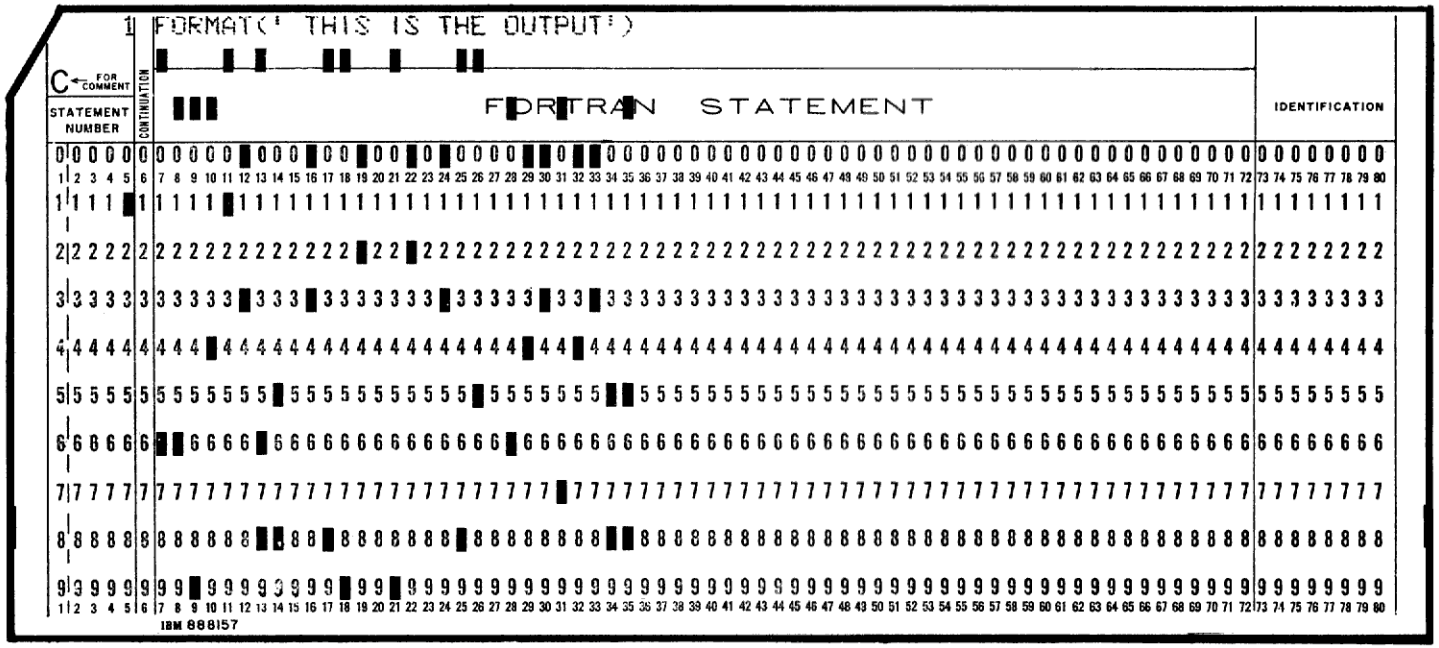
SAMPLE 3X3 MATRIX

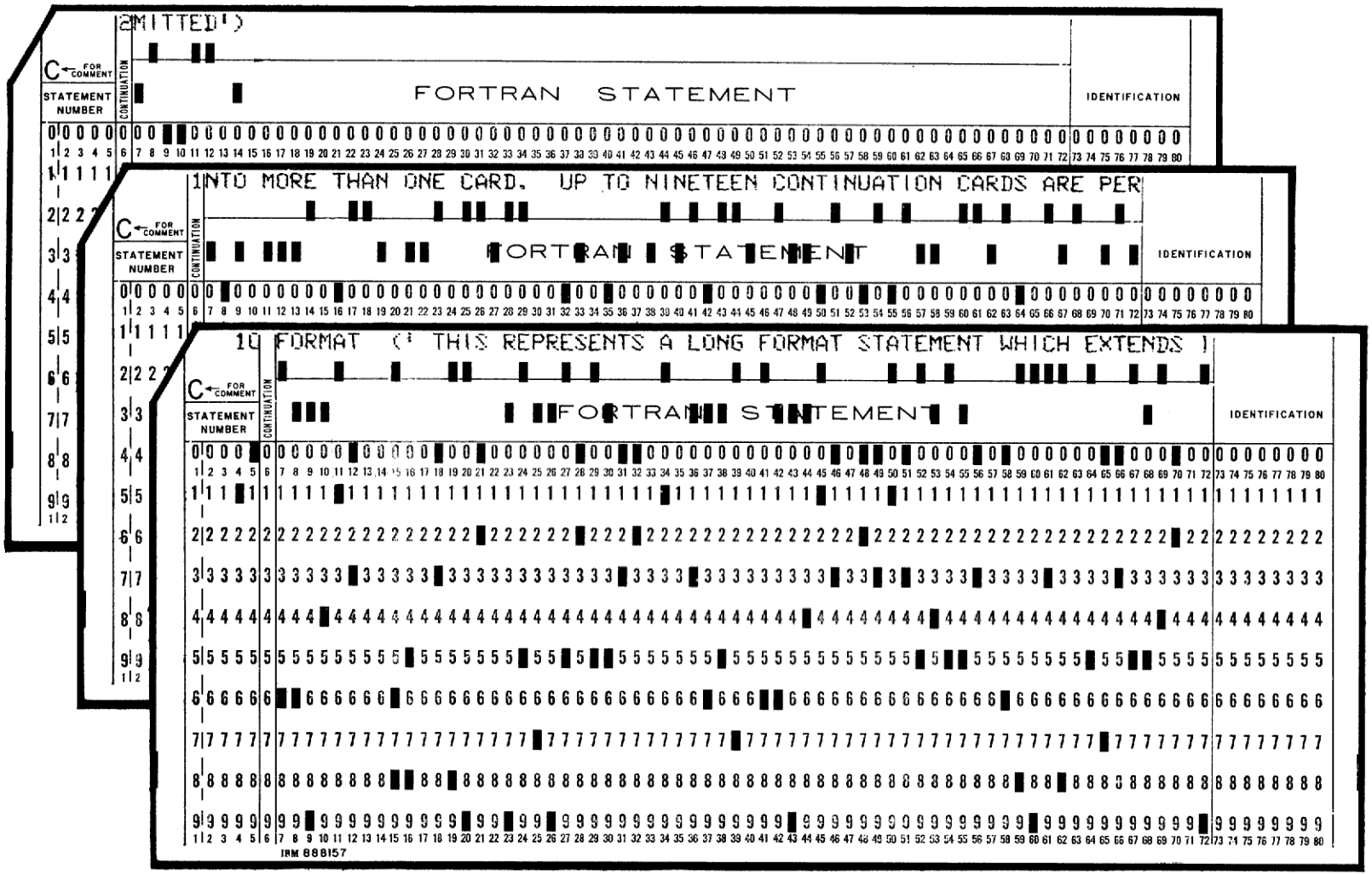




* A standard card form, IBM electro 888157, is available for punching source statements from this form.


10 GO TO 15
C ← FOR COMMENT
STATEMENT NUMBER
CONTINUATION
FORTRAN STATEMENT
IDENTIFICATION
IBM 888157


1 FORMAT(' THIS IS THE OUTPUT')
C ← FOR COMMENT
STATEMENT NUMBER
CONTINUATION
FORTRAN STATEMENT
IDENTIFICATION
IBM 888157


C ← FOR COMMENT
STATEMENT NUMBER
CONTINUATION
FORTRAN STATEMENT
IDENTIFICATION
2MITTED')
1NTO MORE THAN ONE CARD. UP TO NINETEEN CONTINUATION CARDS ARE PER
1 0 FORMAT (' THIS REPRESENTS A LONG FORMAT STATEMENT WHICH EXTENDS)
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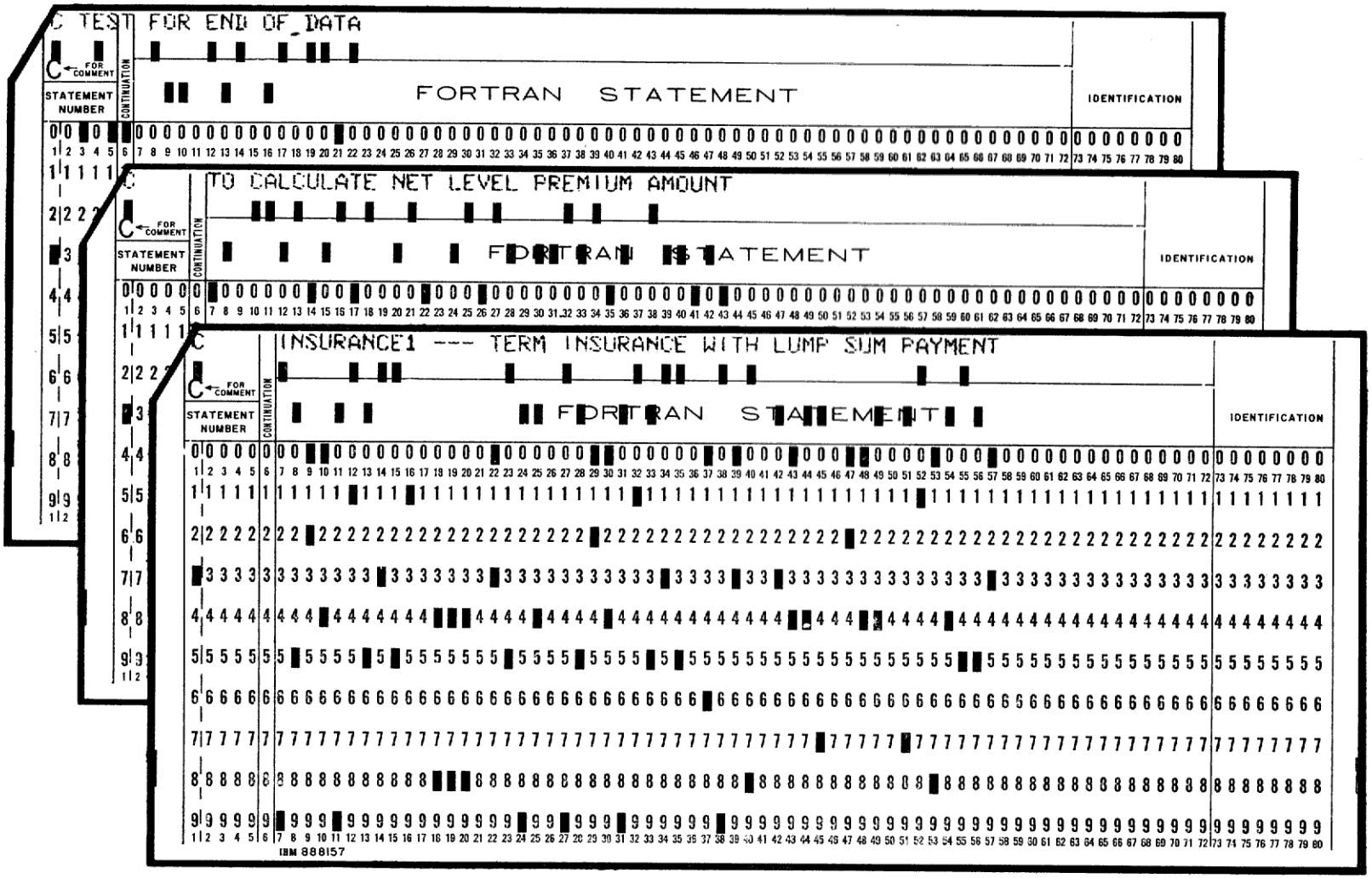
SAMPLE COMMENTS INTERSPERSED AT VARIOUS POINTS IN THE PROGRAM



The complete FORTRAN programming operation can be described by the following typical steps:

1. Organize the problem, determining equations used, etc.
2. Determine which items should be read by the computer at execution time.
3. Write a first draft of the program statements on scratch paper (this permits easy corrections).
    a. Write Input statements.
    b. Write the statements to solve the particular problem.
    c. Determine the quantities to print and write the appropriate output statements.
    d. Add necessary specification statements and comments (C in column 1).
    e. Be sure that all subprograms are headed correctly and all programs have END statements.
4. Copy final draft on coding sheets.
5. Punch the program on cards (many computing centers offer this service if coding forms are used.)
6. Using the FORTRAN compiler program, translate your program to a computer-coded one.
7. Execute your computer-coded program, with any input data you are reading and obtain answers.
8. Examine the results and verify them, debugging if necessary (correct the FORTRAN statements and repeat at step No. 6).

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changes made on page 2.9. The previous editions are not obsoleted.

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