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Subroutine for the Calculation of CODEN Check Characters

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Subroutine for the

Calculation of CODEN Check Characters

David Garvin

A FORTRAN subroutine is described that computes the check character for an ASTM CODEN for Journal Titles. This routine, written for input in Hollerith characters, is adaptable to other coding schemes. A listing of the routine is provided.

Keywords: Check character; CODEN; computer program; journal abbreviations.

1. Introduction

CODEN for journal titles are abbreviations, such as JCPA, that provide a completely defined, short, frequently mnemonic identifier for a serial publication. This system is maintained by the American Society for Testing and Materials and is used both by information systems and some scientific journals.

When other identifiers are added to the CODEN a compact specific reference to an article can be obtained. E.g.

Schofield IJCKBO-1972-4-255

identifies an article by K. Schofield, Int. J. Chem. Kinetics, (1972) vol. 4 pg. 255. In a similar manner the designation

IJCKBO 4(3) 255-336 (1972)

is used as a "bibliographic strip" to identify the page contents of issue no. 3 of volume 4. This is useful in accession procedures in libraries.

The sixth character, "O" above, is a "check character" formed from the first five by a unique algorithm. It is used to spot transcription errors when the CODEN is keyboarded.

In this note a FORTRAN subroutine is provided that calculates and verifies check characters for CODEN. The technical description starts in section 2 and the program listing is in section 4. The application of the routine is discussed below. The algorithm given in the ASTM CODEN publication and used here is stated at the end of this section.

Application There are three types of potential uses for this subroutine.

(1) It may be used to generate check characters for CODEN for use in an information system. At present these characters are not given in the ASTM publication.

(2) It may be used to check the validity of CODEN keyboarded in constructing an information system. This is the most likely use in a small system.

(3) It may serve as a benchmark routine against which the performance of more efficient routines can be tested. This is the most likely use in a large system.

The ASTM algorithm for check characters [1] is quoted below:

"CHECK CHARACTERS

"The following information is included about check characters for those users of the CODEN system who may wish to use the character. Its purpose is to provide a letter or digit which, when properly calculated, will eliminate errors in CODEN notation in the keyboarding stage.

"The initial suggestion for the use of a machine-generated check-letter for controlling errors in CODEN came from A. D. Pratt at the School of Library Science, University of Indiana, Bloomington. F. E. Hajjar is responsible for reducing the idea to practice for Chemical Abstracts Service. The check-character becomes a sixth letter or digit whose value depends upon value and order of the five elements of the CODEN. Any error in a single letter or an inversion of letters, plus most other types of errors, will produce a check character that is inconsistent with the correct one and expose the error. Following is a brief description of the system as used at Chemical Abstracts Service.

"1. CODEN may be entered as a 5- or 6-character field.

(a) If the CODEN is entered as a 5-character field, then a check-character is generated and added as a sixth character.

(b) If the CODEN is entered as a 6-character field, then a check-character is generated from the first five and matched with the sixth. If the check-characters match, the CODEN is verified as being valid. If the check-characters do not match, then the generated character replaces the original check-character and a switch is turned on to be interrogated by the operating program.

"2. The check-character is generated as follows:

(a) Each alpha-numeric character of the CODEN is replaced with an equivalent value. The equivalents are:

CODEN:	A, B, Y, Z, 1, 2, 9, 0
Equivalent:	1, 2, 25, 26, 27, 28, 35, 36

(b) The equation used to generate the check-character is:

$$\frac{(11 \times N_1) + (7 \times N_2) + (5 \times N_3) + (3 \times N_4) + (1 \times N_5)}{34} = X + \frac{\text{remainder}}{34}$$

Where N_1 , N_2 , etc. are the equivalents of the CODEN characters in order of their appearance in the CODEN and X is a whole number that is discarded.

(c) The remainder is converted to a check-character by the following set of equivalents:

remainder:	1, 2, 25, 26, 27, 28, 29, 33, 34
	[34 = 0]

Check-character:	A, B, Y, Z, 2, 3, 4, 8, 9
	[or zero, [sic]]

The numeric check-characters one (1) and zero (0) have been eliminated to avoid confusion with the alphabetic characters I and O.

(d) Sample calculation of a check character for the CODEN
JACS-A:

$$\begin{aligned}N_1 &= J = 10 \\N_2 &= A = 1 \\N_3 &= C = 3 \\N_4 &= S = 19 \\N_5 &= A = 1\end{aligned}$$

Substituting these equivalents for the characters in the CODEN into the equation yields an "X" of 5 and a remainder of 20. The check-character equivalent of 20 is T. Thus the complete CODEN with check-character is JACS-AT."

* * *

The rule as applied in this program calculates X then uses the formula

$$(X-1) \text{ Mod } 34 + 1 = C$$

where C is the check character. This rule is implied in paragraph 2 c in the quotation, where a remainder of zero must be assigned to the check character nine (9).

2. GENERAL DESCRIPTION OF PROGRAM

Name: Subroutine CODCHK (LINE, MINE, IS, IL, IERR)

Language: Fortran IV with "implied do loop" DATA statements

Purpose: Calculation of (or verification of) the check character of a CODEN for Periodical Titles. Uses the algorithm stated in ASTM DS 23B, vol. 1 pg. ix.. [1].

Formal Arguments: LINE: Integer array

MINE: Integer array, 6 words minimum

IS, IL, IERR: Integers

Input Required: The CODEN to be processed is supplied to the routine in the array LINE, one character per word. It is located in the zone LINE (IS) to LINE (IL) where IS and IL are the left and right limits, IS<IL. It is the only item in this zone. In this version the characters are assumed to be Hollerith, in A1 (left adjusted) format.

The first six non-blank characters are processed. Embedded blanks and minus signs are ignored. The sixth character may be missing. Examples of acceptable CODEN are

JACSA, JACS-A, JACS A, JACSAT,

J A C S A T

Signals returned: Input errors are signalled by a non-zero value of IERR returned by the routine

IERR = 0	Successful calculation
= 1	Check character provided at input did not match the calculated one
= 2	There were more than six characters in the input (first six used)
= 4	There were fewer than five legal characters in the input (no calculation made)
= 8	Illegal character in the input (ignored)

These signals are additive.

Text returned: The routine returns a six character CODEN in MINE, one character per word, A1 format. The sixth character is the check character (except when IERR=4, in which case MINE (6) is left blank).

3. REMARKS:

Subroutine operation: The input characters are converted to integers using a table search of a dictionary, INDICT. The word INDICT (K) contains the character that corresponds to the integer K in the algorithm. A similar dictionary, JØDICT, is used to convert the integer value of the check character to the character itself. Both dictionaries in this version contain left adjusted Hollerith characters. Other character codes may be substituted. The two constants used in the program, blank and minus, are defined in data.

This table search procedure is much slower than a table look-up based on right adjusted integers. Any production program should use the latter technique. The search procedure is used here because ANSI FORTRAN does not provide for shifting Hollerith characters, this being the language feature needed if the procedure is to be changed.

Relation to other routines: This subroutine must be called into action by another program. The essential function of the calling program is to isolate the CODEN, that is, to set pointers (IS and IL) showing where in the array LINE the CODEN (and only it) is located. The calling program must also dispose of the result returned: print error messages, replace the old with the new, etc. The nature of this calling routine cannot be specified here since it must be constructed to match the file of material that is to be examined. (However, a sample is included in the program listing).

4. PROGRAM LISTING:

Listings of two routines are attached. These are Subroutine CODCHK, which does the work, and Main program CODEN, which is an example showing how CODCHK can be used with simple card input. An example of the output follows the listings.

[1] Blumenthal, J. G., Karaman, M. and Peters, A. "CODEN for Periodical Titles" ASTM Data Series DS 23B (American Society for Testing and Materials, Philadelphia, 1970), Volume 1 pgs ix-x.

SUBROUTINE CODCHK(LINE,MINE,IS,IL,IERR)	CDK	1
DIMENSION LINE(1),MINE(1)	CDK	2
C SIZES OF LINE AND MINE ARE SET IN CALLING PROGRAM	CDK	2A
C MINIMUM IS 6 WORDS EACH	CDK	2B
DIMENSION INDICT(36),JODICT(34),LIN2(6)	CDK	3
C ROUTINE COMPUTES A CHECK CHARACTER FOR A CODEN WRITTEN IN ONE OF	CDK	4
C THESE FORMS	CDK	5
C JACSA JACS-A JACS A JACSAT	CDK	6
C (EMBEDDED BLANKS AND DASH IGNORED)	CDK	7
C ROUTINE RECEIVES SIX CHAR (A1 FORMAT) IN -LINE- AND RETURNS	CDK	8
C SIX CHAR (A1 FORMAT) IN MINE. THE SIXTH CHAR IN MINE IS THE	CDK	9
C CHECK CHARACTER CALC PER PG IX-X OF ASTM DATA SER. DS 23 B	CDK	10
C THE ARRAY LINE IS NOT CHANGED.	CDK	11
C IF THE INCOMING CODEN HAD A CHECK CHAR.,THAT IS COMPARED WITH	CDK	12
C THE CALC MADE HERE.	CDK	13
C THE FORMAL ARGUMENT -IERR- IS RETURNED WITH THESE VALUES	CDK	14
C AND MEANINGS	CDK	15
C IERR=0 OK	CDK	16
C IERR=1 CHECK CHAR DID NOT MATCH	CDK	17
C IERR = 2 CODEN HAD MORE THAN 6 CHARACTERS (FIRST 6 USED)	CDK	18
C IERR = 4 CODEN HAD LESS THAN 4 CHARACTERS (NO CALC. MADE)	CDK	19
C IERR = 8 ILLEGAL CHARACTER IN CODEN	CDK	20
C CONSTANTS	CDK	21
DATA IBLNK,IMIN/ 1H,1H-/	CDK	22
C DICTIONARIES	CDK	23
C INPUT ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890 (36)	CDK	24
C OUTPUT ABCDEFGHIJKLMNOPQRSTUVWXYZ23456789 (34)	CDK	25
C INPUT CHAR DICTIONARY	CDK	26
DATA (INDICT(I),I=1,36)/	CDK	27
1 1HA,1HB,1HC,1HD,1HE,1HF,1HG,1HH,1HI,1HJ,1HK,1HL,1HM,1HN,1HO,1HP,	CDK	28
2 1HQ,1HR,1HS,1HT,1HU,1HV,1HW,1HX,1HY,1HZ,	CDK	29
3 1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9,1HO/	CDK	30
C OUTPUT DICTIONARY FOR CHECK CHARACTER	CDK	31
DATA(JODICT(I),I=1,34) /	CDK	32
1 1HA,1HB,1HC,1HD,1HE,1HF,1HG,1HH,1HI,1HJ,1HK,1HL,1HM,1HN,1HO,1HP,	CDK	33
2 1HQ,1HR,1HS,1HT,1HU,1HV,1HW,1HX,1HY,1HZ,	CDK	34
3 1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9 /	CDK	35
DO 10 I=1,6	CDK	36
MINE(I)=1H	CDK	37
10 LIN2(I)=0	CDK	38
IERR=0	CDK	39
MODE=0	CDK	40
K=0	CDK	41
IF (IL-IS-4) 140,20,20	CDK	42
C SEARCH INDICT FOR THE CHARACTERS IGNORE BLANKS AND MINUS	CDK	43
20 DO 80 I=IS,IL	CDK	44
IF (LINE(I)-IBLNK) 30,80,30	CDK	45
30 IF (LINE(I)-IMIN) 40,80,40	CDK	46
40 DO 50 J=1,36	CDK	47
IF (LINE(I)-INDICT(J)) 50,60,50	CDK	48
50 CONTINUE	CDK	49
C ILLEGAL CHARACTER	CDK	50
IF (IERR.LT.8) IERR=IERR +8	CDK	51
GO TO 80	CDK	52
C CONVERT VALUE TO AN INTEGER	CDK	53
60 K=K+1	CDK	54
IF (K.LE.6) GO TO 70	CDK	55
C MORE THAN 6 CHAR IN FIELD	CDK	56
IF (MOD(IERR,4).LE.1) IERR=IERR+2	CDK	57
GO TO 90	CDK	58
70 LIN2(K)=J	CDK	59

80	MINE(K)=LINE(I)	CDK	60
	CONTINUE	CDK	61
	IF (K-5) 140,100,90	CDK	62
90	MODE=1	CDK	63
100	MSUM=11*LIN2(1)	CDK	64
	MSUM=MSUM+7*LIN2(2)	CDK	65
	MSUM=MSUM+5*LIN2(3)	CDK	66
	MSUM=MSUM+3*LIN2(4)	CDK	67
	MSUM=MSUM+LIN2(5)	CDK	68
C	COMPUTE NUMERICAL EQUIVALENT OF CHECK CHARACTER	CDK	69
	ICK=MOD(MSUM-1,34)+1	CDK	70
	ICHECK=JODICT(ICK)	CDK	71
	IF (MODE-1) 130,110,130	CDK	72
C	COMPARE WITH EXISTING CHECK CHARACTER	CDK	73
110	JCK=LIN2(6)	CDK	74
	JCHECK=INDICT(JCK)	CDK	75
	IF (ICHECK-JCHECK) 120,130,120	CDK	76
C	INCONSISTENT CHECK CHARACTER	CDK	77
120	IF (MOD(IERR,2).LT.1) IERR=IERR+1	CDK	78
130	MINE(6)=ICHECK	CDK	79
	GO TO 150	CDK	80
C	FEWER THAN 5 CHARACTERS	CDK	81
140	IF (MOD(IERR,8).LT.4) IERR=IERR+4	CDK	82
150	RETURN	CDK	83
	END	CDK	84-

C	SAMPLE MAIN PROGRAM FOR CODEN INPUT FROM CARDS	CDN	1
	DIMENSION LINE(80),MINE(80)	CDN	2
C	CARD READER AND PRINTER UNITS	CDN	3
	KR=5	CDN	4
	KP=6	CDN	5
C	ZONE ON THE INPUT WHERE CODEN IS LOCATED	CDN	6
	I1=1	CDN	7
	I2=10	CDN	8
	PRINT 10	CDN	9
10	FORMAT ('1 OUTPUT INPUT FOR CODEN CHECK PROGRAM')	CDN	10
C	READ THE INPUT. THIS IS UNIVAC FORTRAN V	CDN	11
20	READ (KR,40,END=70) (LINE(I),I=1,80)	CDN	12
	CALL CODCHK (LINE,MINE,I1,I2,IERR)	CDN	13
	IF (IERR.EQ.0) GO TO 30	CDN	14
	WRITE (KP,50) IERR	CDN	15
30	WRITE (KP,60) (MINE(I),I=1,6),(LINE(I),I=I1,I2)	CDN	16
	GO TO 20	CDN	17
40	FORMAT (80A1)	CDN	18
50	FORMAT (' ***** ERROR TYPE' I3, ' ON NEXT CARD')	CDN	19
C	FORMAT FOR ARRAY LINE SHOULD ALLOW FOR I2-I1+1 CHARACTERS	CDN	20
60	FORMAT (1H 6A1,6X,30A1)	CDN	21
70	STOP	CDN	22
	END	CDN	23-

TEST OF SUBROUTINE CODCHK (TYPED COPY OF OUTPUT)

OUTPUT	INPUT FOR CODEN CHECK PROGRAM
*****	ERROR TYPE 4 ON NEXT CARD
ABCD	ABCD
*****	ERROR TYPE 3 ON NEXT CARD
ABCDEW	ABCDEFG
ANYAA9	ANYAA
APOPAI	APOPA
*****	ERROR TYPE 1 ON NEXT CARD
CHREAY	CHREAB
*****	ERROR TYPE 8 ON NEXT CARD
GCAXZ6	*GCAXZ
*****	ERROR TYPE 8 ON NEXT CARD
GCAXZ6	GC*AXZ
*****	ERROR TYPE 12 ON NEXT CARD
GCAZ	GC*A*Z
IJCKBO	IJCKB
JACSAT	JACSA
JACSAT	JACS-A
JACSAT	J A C SAT
*****	ERROR TYPE 1 ON NEXT CARD
JASCAR	JASCAT
JATPA3	JATPA
JGREA2	JGREA
NBCIAG	NBCIA
NBCIAG	NBCIA-G

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