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ABSTRACT

Computer routines designed to determine if a song already exists in a song file data base are described. Written in FORTRAN IV, SONG FILE DATA MATCH compares the note sequence of songs in the data base and the one to be added to it. Information is then presented to the user which analyzes the sequence of notes and compares them to other songs. This document is intended to serve as the software documentation for the programs. Included are a program description, data format specifications, program constraints and limitations, and operating instructions. Program flowcharts, program listings, and sample data forms and reports are also provided. (DGC)

SOUTHWEST REGIONAL LABORATORY TECHNICAL NOTE

DATE: December 20, 1972

NO: TN 5-72-63

TITLE: SONG FILE MATCH

AUTHOR: Lanaii Kline

ABSTRACT

Song File Match is a computer program which compares the note sequence of a new entry to those previously stored in the song file database. Songs containing matching sequences are listed.

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1.0 - PROGRAM IDENTIFICATION

SONG FILE NOTE MATCH

2.0 - OBJECTIVE

To check if a song already exists in the song file database by comparing the note sequence of the songs in the database and the one to be added to the database later.

3.0 - PROGRAM DESCRIPTION

3.1 - Program Logic

The Song File database is read and sorted by note sequence (twelve notes). A song title and note sequence is read. The program searches the Song File for a match on the note sequence. All matches are printed. This process continues until all songs to be checked have been processed.

3.2 - Variables and Internal Tables

Integer Arrays:

IHEAD (45) - is a scratch file used for the sort subroutine.

LIST (45) - contains the indices of the array which was sorted in the order of the sort.

NOTE (25) - contains the input record which is to be checked for duplication in the Song File.

POINT (45) - contains the indices of LIST.

SONG (45, 59) - contains the Song File in core.

Integers:

COMPAR - is an input/output argument for the functions SORT and COMPAR.

M - is the denominator for finding the range of records to search in the database.

S - is the smallest mean be.

UB - is the upper bound of the portion of the song file to be searched.

LOW - is the lower bound of the portion of the song file to be searched.

P - is the index of the note in the records of the song file and the input array which are to be compared for a match.

NUMB - in the maximum number of elements in the song file to be searched. 1 NUMB N.

N - is the number of records in the song file.

MID - is the smallest range of records used in searching for a match.

OLD - is the old lower bound.

OLDER - is the old upper bound.

I - is the index for LIST.

M - is the index for POINT.

RANGE - is the range of records to be searched in the Song File. RANGE = UP - LOW.

BOTTOM - is the lower portion of the array which is not to be checked. When P = 14 then BOTTOM = 0; when P = 15, then BOTTOM = LOW.

5.0 - DATA DESCRIPTION

5.1 - Input Formats

See Attachment 1

5.2 - Output Formats

See Attachment 1

6.0 - PROGRAM CONSTRAINTS AND LIMITATIONS

6.1 - Programming Language

FORTRAN IV

6.2 - Vendor

University of California, Los Angeles Campus Computing Network.

6.3 - Storage Requirements

Compilation: 98K

Execution: 56K

I/O Requests: 361

6.4 - Hardware Configuration

IBM 360 Model 91, Disk, Card Reader, Line Printer

6.5 - Program Parameters

The program is currently limited to forty-five records in song file. To increase this number change the following cards:

```
DIMENSION NOTE (25), LIST (45)*, 1 HEAD (45)*, POINT (45)*
COMMON /X1/ SONG (45, 59)*
1F (N.GT.45) Go to 23
```

in Integer function COMPAR

```
COMMON /X1/ SONG (45, 59)*
```

6.6 - Error Messages

EXCEEDED THE SONG ARRAY

Processing terminates

7.0 - OPERATING INSTRUCTIONS

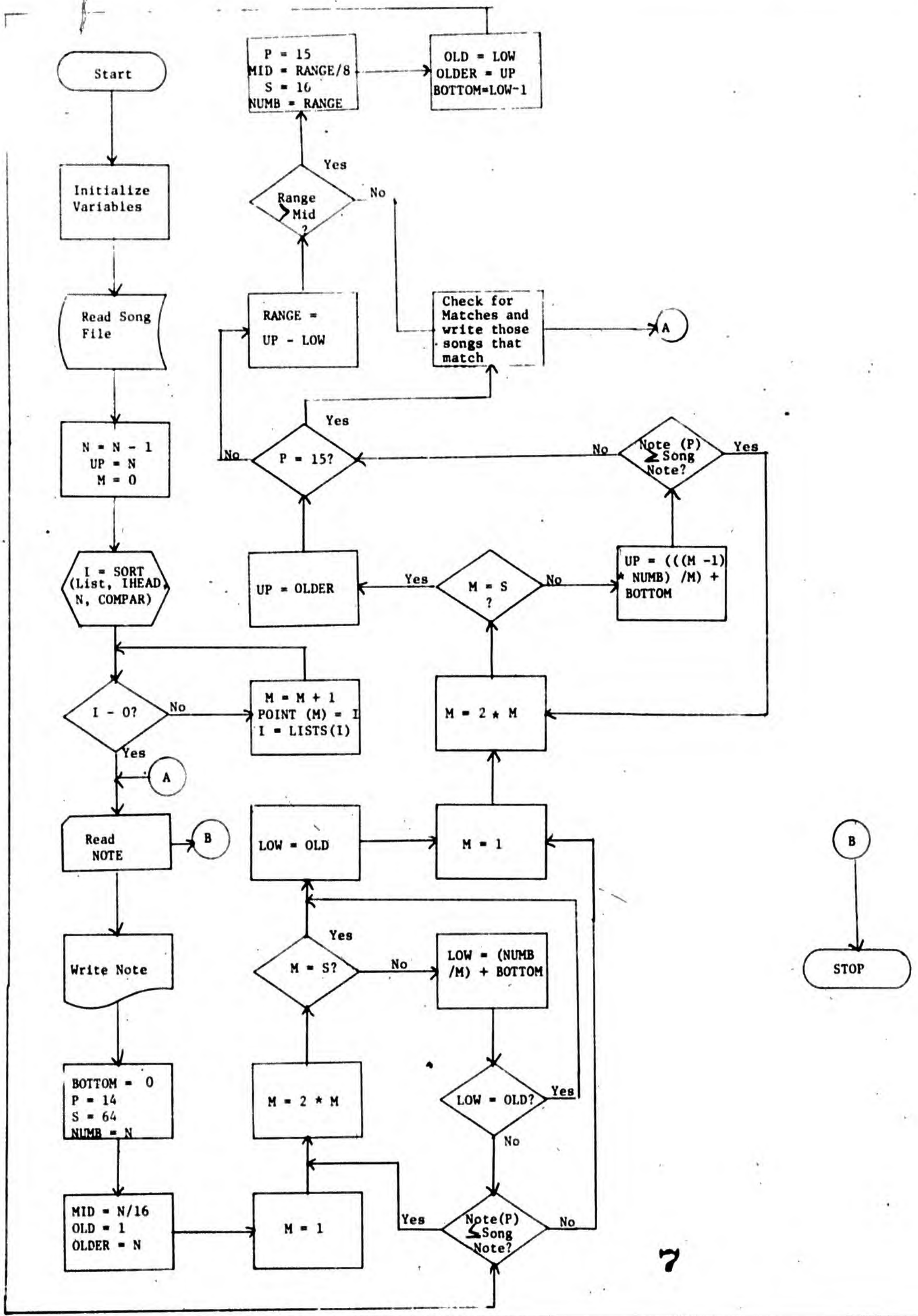
Run in batch mode

```
// job card
// password
// EXEC FORTGCLG
// FORT. SYSIN DD *
   program deck
/ *
// GO. FT04F001 DD DSN =
// GO. SYSIN DD *
   data deck
/ *
//
```

FLOWCHART LAYOUT FORM

PROGRAMMER: Lanaii Kline DATE: ________

PROGRAM ID: SONG FILE MATCH PAGE 4 OF 1



9.0 - PROGRAM LISTING

```
      IMPLICIT INTEGER (A-Z)
      DIMENSION NOTE(25),LIST(45),IHEAD(45),POINT(45)
      COMMON /X1/SONG(45,59)
      EXTERNAL COMPAR
C
C      M     - DENOMINATOR FOR FINDING SEARCH RANGE TO PARTITION THE
C              DATABASE
C      S     - EQUALS THE SMALLEST DENOMINATOR USED TO PARTITION THE
C              SONG FILE ARRAY
C      UP    - UPPER BOUND OF PORTION OF SONG FILE TO BE SEARCHED
C      LOW   - LOWER BOUND OF PORTION OF SONG FILE TO BE SEARCHED
C      P     - INDEX OF NOTE IN NOTE SEQUENCE ARRAY
C      NUMB  - NO. OF ELLEMENTS IN THE SONG FILE ARRAY
C      N     - NO. OF ELLEMENTS IN THE SONG FILE ARRAY
C      MID   - THE SMALLEST RANGE OF ELEMENTS TO BE PARTITIONED FROM
C              THE SONG FILE ARRAY
C      OLD   - THE OLD LOWER BOUND
C      OLDER - THE OLD UPPER BOUND
C
      WRITE(6,10)
10    FORMAT('1')
      N=1
      LOW=1
C
C     READ THE SONG FILE
C
3     READ(4,1,END=2) (SONG(N,I),I=1,59)
1     FORMAT(5X,12A4,A3,12I2/5X,18A4,A3/I5,4X,13A4,A3)
      N=N+1
      IF(N.GT.45) GO TO 23
      GO TO 3
C
C     END READING SONG FILE - SORT NOTE SEQUENCES
C
2     N=N-1
      UP=N
      M=0
      I=SORT(LIST,IHEAD,N,COMPAR)
5     IF(I.EQ.0) GO TO 4
      M=M+1
      POINT(M)=I
      I=LIST(I)
      GO TO 5
C
C     READ INPUT CARD
C
4     READ(5,6,END=7) (NOTE(J),J=1,25)
6     FORMAT(5X,12A4,A3,12I2)
      WRITE(6,8) (NOTE(J),J=1,25)
8     FORMAT('0'////'0',12A4,A3,10X,'NOTE SEQUENCE -',1X,12I2)
      BOTTOM=0
      P=14
      S=64
      NUMB=N
      MID=N/16
      OLD=1
      OLDER=N
C
C     TEST FOR LOWER BOUND : LOW
C
20    M=1
9     M=2*M
      IF(M.EQ.S) GO TO 11
      LOW=(NUMB/M)+BOTTOM
      IF(LOW.LT.OLD) GO TO 11
      IF(NOTE(P).LE.SONG(POINT(LOW),P)) GO TO 9
C
C     NOTE GREATER THAN LOW
C     FOUND LOWER BOUND
C
C     TEST FOR UPPER BOUND : UP
C
18    M=1
12    M=M*2
      IF(M.EQ.S) GO TO 19
      UP=(((M-1)*NUMB)/M)+BOTTOM
      IF(NOTE(P).GE.SONG(POINT(UP),P)) GO TO 12
C
C     NOTE LESS THAN UP
C     FCUND UPPER BOUND
C
22    IF(P.EQ.15) GO TO 21
      RANGE=UP-LOW
      IF(RANGE.GT.MID) GO TO 13
C
C     TEST IF NOTE IS IN RANGE
C
21    DO 14 I=LOW,UP
      DO 15 J=14,25
      IF(NOTE(J).NE.SONG(POINT(I),J)) GO TO 14
C
C     NOTES MATCH SO FAR
C
15    CCNTINUE
C
C     NOTES MATCH NOTES OF SCNG THE DATABASE
C
      WRITE(6,16) SONG(POINT(I),45),(SONG(POINT(I),J),J=1,44)
16    FORMAT('OTHE NOTE SEQUENCES MATCH THAT OF SONG NUMBER',1X,I5/' ',
     +10X,12A4,A3,10X,'SEQUENCE -',1X,12I2/' ',10X,18A4,A3)
14    CONTINUE
C
C     NC MATCH
C
      WRITE(6,17)
17    FORMAT('ONO MORE MATCHES FOR THIS NOTE SEQUENCE')
      GC TO 4
C
C     LCWER BOUND IS 1 OF BOTTOM OF RANGE
C
```

```
 11    LOW=OLD
       GO TO 18
C
C      RANGE IS TOO LARGE
C
 13    P=15
       MID=RANGE/8
       S=16
       NUMB=RANGE
       OLD=LOW
       OLDER=UP
       BCTTOM=LCW-1
       GO TO 20
C
C      LOWER BOUND IS N OR TOP OF RANGE
C
 19    UP=OLDER
       GO TO 22
C
C      READ MORE DATA THAN ARRAY WAS DIMENSIONED
C
 23    WRITE(6,24)
 24    FORMAT('1 EXCEEDED THE ARRAY SONG')
C
C      END OF FILE
C
 7     WRITE(6,10)
       STOP
       END
```

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SWRI

COMPUTER SYSTEMS
FILE/RECORD LAYOUT

RECORDING MODE:
FIXED ■
LENGTH 80
VARIABLE □
MAX
MIN

BLOCKING FACTOR:
BLOCK CONTAINS 91 RECORDS

REMARKS:
Output file uses same format as the input file.

TITLE: Database - Song File DATE:

FILE ID: Input

PROGRAMMER: Lanaii Kline

CARD LAYOUT □

TAPE RECORD LAYOUT ■

FORMAT LEGEND:

Δ = Blank	P = Packed Dec.
A = Alpha	O = Octal
N = Numeric	H = Hexadecimal
X = Alpha/Num.	B = Binary

RECORD I.D.
Title/Note Sequence

TITLE

NOTE SEQUENCE
(12 Notes)

FORMAT Δ A N N N N N N N N N N N N

POSITIONS 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

□ CONTINUED

RECORD I.D.
Composer/Publisher

COMPOSER/PUBLISHER

FORMAT Δ A

POSITIONS 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

□ CONTINUED

RECORD I.D.
Song Characteristics

Song Number

metre

mode

range

Melodie Features

Rhythmic Features

Structural Features

Has Monic Features

seasons

holidays

American

Non-American

FORMAT N Δ AAAΔ N Δ N Δ N Δ N Δ ΔA AA Δ

POSITIONS 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

□ CONTINUED

RECORD I.D.

FORMAT

POSITIONS 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

Page ___ of ___

COMPUTER SYSTEMS
FILE/RECORD LAYOUT

TITLE: Match Record   DATE: ___

FILE ID: Input

PROGRAMMER: Lanaii Kline

RECORDING MODE:
FIXED ■
LENGTH 80
VARIABLE □
MAX ___
MIN ___

BLOCKING FACTOR:
BLOCK CONTAINS ___ RECORDS

REMARKS:

CARD LAYOUT ■
TAPE
RECORD LAYOUT □

FORMAT LEGEND:

△ = Blank	P = Packed Dec.
A = Alpha	O = Octal
N = Numeric	H = Hexadecimal
X = Alpha/Num.	B = Binary

RECORD I.D.

		TITLE	NOTE Sequence (12 notes)											
FORMAT	△	A	N	N	N	N	N	N	N	N	N	N	N	N

POSITIONS 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

□ CONTINUED
RECORD I.D.

FORMAT

POSITIONS 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

□ CONTINUED
RECORD I.D.

FORMAT

POSITIONS 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

□ CONTINUED
RECORD I.D.

FORMAT

POSITIONS 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

ATTACHMENT 2

```
      INTEGER FUNCTION CCMPAR(I,J)
      IMPLICIT INTEGER (A-Z)
      COMMON /X1/SONG(45,59)
      K=14
40    IF(SONG(I,K)-SONG(J,K)) 10,20,30
10    CCMPAR=-1
      RETURN
30    CCMPAR=1
      RETURN
20    CCMPAR=0
      K=K+1
      IF(K.LE.25) GO TO 40
      RETURN
      END
      INTEGER FUNCTION SORT(LISTS,IHEAD,N,COMPAR)
C
C     GENERAL SORT ROUTINE
C     LISTS IS AT LEAST N WORDS LONG, WHERE N IS THE NUMBER OF RECORDS
C     TO BE SORTED.
C     IHEAD IS ALSO N WORDS LONG AND IS USED AS A SCRATCH AREA.
C     COMPAR IS A 2-ARGUMENT INTEGER FUNCTION HAVING A NEGATIVE VALUE
C     IF THE RECORD REFERENCED BY THE FIRST ARGUMENT IS TO BE SORTED
C     BEFORE THE RECORD REFERENCED BY THE SECOND ARGUMENT, A ZERO VALUE
C     IF THE ORDER IS IMMATERIAL, AND A POSITIVE VALUE OTHERWISE.
C     SINCE SORT DEALS WITH RECORD INDEXES ONLY, THE SORT KEYS MAY BE
C     ARBITRARILY COMPLEX, AND THE RECORDS TO BE SORTED NEED NOT BE
C     IN MEMORY.
C
C     USAGE
C
C     INTEGER SORT
C     EXTERNAL COMPAR (OPTIONAL, COMPAR MAY BE INTERNAL)
C     I=SORT(LIST,IHEAD,N,COMPAR)
C   A IF (I.EQ.0) GO TO B
C     DO ANY PROCESSING FOR RECORD I HERE.
C     I=LIST(I)
C     GO TO A
C   B CONTINUE
C
      IMPLICIT INTEGER (A-Z)
      INTEGER COMPAR,DIRECT
      INTEGER LISTS(N),IHEAD(N)
      EQUIVALENCE (MP,DIRECT),(JHEAD,NCHAIN)
      EXTERNAL COMPAR
C
C     START BY SCANNING ALL RECORDS AND DETECTING ASCENDING OR
C     DESCENDING CHAINS.  PUT THE HEADS OF THESE CHAINS IN HEAD.
C
      M=1
C
C     INDICATE BEGINNING OF CHAIN
C
      DIRECT=0
      I=1
C
C     INDICATE RECORD 1 HEAD OF CHAIN
C
      JHEAD=1
      LISTS(1)=0
1     IF(I.GE.N) GO TO 10
      I1=I+1
C
C     CHECK SEQUENCE OF TWO ADJACENT RECORDS.
C
      IF(COMPAR(I,I1)) 2,22,8
22    IF(DIRECT) 9,3,4
C
C     RECORDS I,I+1 ARE IN ASCENDING SEQUENCE.
C
```

```
2       IF(DIRECT) 7,3,4
C
C       START A FORWARD CHAIN.
C
3       DIRECT=1
        JHEAD=I
C
C       CONTINUE A FORWARD CHAIN.
C
4       LISTS(I)=I1
5       I=I1
        GO TO 1
C
C       HAD A CHAIN, GOT A SEQUENCE CHANGE.
C       INDICATE END OF CHAIN
C
6       LISTS(I)=0
C
C       SAVE HEAD OF CHAIN
C
7       IHEAD(M)=JHEAD
        M=M+1
        DIRECT=0
        GO TO 5
C
C       RECORDS I,I+1 ARE IN DESCENDING SEQUENCE.
C
8       IF(DIRECT) 9,99,6
C
C       START A BACKWARD CHAIN.
C
99      DIRECT=-1
C
C       INDICATE END OF CHAIN
C
        LISTS(I)=0
C
C       CONTINUE A BACKWARD CHAIN
C
9       LISTS(I1)=I
C
C       UPDATE HEAD OF CHAIN
C
        JHEAD=I1
        GO TO 5
C
C       END OF CHAIN DETECTION.  CLEAN UP AND START MERGE PASS.
C
10      IHEAD(M)=JHEAD
        IF (DIRECT.GE.0) LISTS(I)=0
        IF (DIRECT.EQ.0) IHEAD(M)=N
11      I=-1
        MP=0
12      I=I+2
        IF (I.LT.M) GO TO 15
```

```
      IF (I.EQ.M) GO TO 14
13    M=MP
      IF (M.NE.1) GO TO 11
      SCRT=IHEAD(1)
      IHEAD(1)=0
      RETURN
14    MP=MP+1
      IHEAD(MP)=IHEAD(I)
      IF (I.EQ.1) GO TO 13
      IHEAD(I)=0
      GO TO 13
15    J1=IHEAD(I)
      J2=IHEAD(I+1)
      IHEAD(I)=0
      IHEAD(I+1)=0
      I1=J1
      I2=J2
      MP=MP+1
      NCHAIN=0
16    IF (COMPAR(J1,J2).LE.0) GO TO 17
C
C     J2 SHOULD CCME BEFORE J1.
C
      IF (NCHAIN.EQ.0) IHEAD(MP)=J2
      IF(NCHAIN.EQ.1) LISTS(I1)=J2
      NCHAIN=2
      I2=J2
      J2=LISTS(I2)
      IF(J2.NE.0) GO TO 16
      LISTS(I2)=J1
      GO TO 12
C
C     J1 SHOULD COME BEFORE J2.
C
17    IF (NCHAIN.EQ.0) IHEAD(MP)=J1
      IF (NCHAIN.EQ.2) LISTS(I2)=J1
      NCHAIN=1
      I1=J1
      J1=LISTS(I1)
      IF(J1.NE.0) GO TO 16
      LISTS(I1)=J2
      GC TO 12
      END
```

ATTACHMENT 3
SAMPLE INPUT

```
THE BUNNY HOP                                  1212121410101010101051212
THE MEXICAN HAT DANCE                          1816181615141820191141617
THE WASSAIL SONG                               1818151515121214151010010
MY HAT IT HAS THREE CORNERS                    1818161617171515141414 18
OH WHERE IS THAT DOGGY IN THE WINDOW           1417181213151816171181212
THE CHIPMUNK SONG                              1818161715121314171181220
LONDON BRIDGES FALLING DOWN                    1818181617181819191951413
HERE WE GO ROUND THE MULBERRY BUSH             1312141516171819202111315
```

```
  MARY HAD A LITTLE LAMB                             181618161514182019141617
  FOLK SONG
 1    11  1   1                   1                     1 301
  WHITE CORAL BELLS                                  131214151617181920211315
  GIRL SCOUT SONG
 2    225      1    1                         2 420
  THREE BLIND MICE                                   181818161718181919151413
  CHILDREN'S SONG
 3    31      1                   1                     1 205
  ROW ROW YOUR BOAT                                  181816171512131417181220
  ROUND
 4    522 1          1          1                       11001
  GREEN GROW THE LILACS                              181816161717151514141418
  FOLK SONG
 5    111   1                     1                     1 120
  RAINDROPS KEEP FALLING ON MY HEAD                  181815121416 3 4 8 9 112
  BACHARACH
 6    11  1   1                   1                     2 340
  YELLOW SUBMARINE                                   181819191717202021212222
  BEATLES
 7    225      1    1   1         1                     1 303
  MICHELLE                                           121212121212 8 1 2 6 9 3
  BEATLES
 8    31      1         1                               11020
  BLOWIN IN THE WIND                                 181819192021222524271416
  PETER, PAUL AND MARY
 9    111                                               11010
  IT HAD TO BE YOU                                   181217181818181815151417
  UNKNOWN
10    12      1     1                                   3 330
  TEA FOR TWO                                        151716121413171815121416
  ANONYMOUS
11    11    1         1          11       1             1 202
  SILENT NIGHT                                       121212121417171414171717
  FRANZ GRUBER
12    111 1                                             1 220
  THE YELLOW ROSE OF TEXAS                           181818181815151515171414
  ANONYMOUS
13    1 1  1                                            2 450
  STAR SPANGLED BANNER                               181818171714151612171819
  FRANCES SCOTT KEY
14    1     1                                           1 110
  JINGLE BELLS                                       181815171717181919182021
  CHRISTMAS
15    056   111                                         1 130
  TIPTOE THROUGH THE TULIPS                          181618161514182019141617
  TINY TIM
16    111 111                         1                 1 1 01
  MARY HAD A LITTLE LAMB                             131214151617181920211315
  CHILDREN'S NURSERY RHYME
17    211                 1         1         1       1 1 220
  KUMBYYA MY LORD                                    181818161718181919151415
  AFRICAN FOLK SONG
18    312       1          1          1           1 1   31005
  SHALOM CHAVERIM                                    201816171512131417181220
  HEBREW CBANNUKAK SONG
19    053           1         1       1       1      1 3 210
  SUNRISE SUNSET                                    181812171517151417181912
  FIDDLER ON THE ROOF
20             1              1                        1 1 10
  GETTING TO KNOW YOU                               181815171812101417191919
  ROCGERS AND HAMMERSTEIN
21    111                                              1 710
```

Attachment 4
Sample Run

```
THE BUNNY HOP                                                NOTE SEQUENCE - 12 12 12 14 10 10 10 10 10 15 12 12

NO MORE MATCHES FOR THIS NOTE SEQUENCE




THE MEXICAN HAT DANCE                                        NOTE SEQUENCE - 18 16 18 16 15 14 18 20 19 14 16 17

THE NOTE SEQUENCES MATCH THAT OF SONG NUMBER      1
             MARY HAD A LITTLE LAMB                                      SEQUENCE - 18 16 18 16 15 14 18 20 19 14 16 17
             FOLK SONG

THE NOTE SEQUENCES MATCH THAT OF SONG NUMBER     16
             TIPTOE THROUGH THE TULIPS                                   SEQUENCE - 18 16 18 16 15 14 18 20 19 14 16 17
             TINY TIM

NO MORE MATCHES FOR THIS NOTE SEQUENCE




THE WASSAIL SONG                                             NOTE SEQUENCE - 18 18 15 15 15 12 12 14 15 10 10 10

NO MORE MATCHES FOR THIS NOTE SEQUENCE




MY HAT IT HAS THREE CORNERS                                  NOTE SEQUENCE - 18 18 16 16 17 17 15 15 14 14 14 18

THE NOTE SEQUENCES MATCH THAT OF SONG NUMBER      5
             GREEN GROW THE LILACS                                       SEQUENCE - 18 18 16 16 17 17 15 15 14 14 14 18
             FOLK SONG

NO MORE MATCHES FOR THIS NOTE SEQUENCE




OH WHERE IS THAT DOGGY IN THE WINDOW                         NOTE SEQUENCE - 14 17 16 12 13 15 18 16 17 16 12 12

NO MORE MATCHES FOR THIS NOTE SEQUENCE
```

```
THE CHIPMUNK SONG                                                NOTE SEQUENCE - 18 18 16 17 15 12 13 14 17 18 12 20

THE NOTE SEQUENCES MATCH THAT OF SONG NUMBER      4
          ROW ROW YOUR BOAT                                                SEQUENCE - 18 18 16 17 15 12 13 14 17 18 12 20
          ROUND

NO MORE MATCHES FOR THIS NOTE SEQUENCE




LONDON BRIDGES FALLING DOWN                                      NOTE SEQUENCE - 18 18 18 16 17 18 18 19 19 15 14 13

THE NOTE SEQUENCES MATCH THAT OF SONG NUMBER      3
          THREE BLIND MICE                                                 SEQUENCE - 18 18 18 16 17 18 18 19 19 15 14 13
          CHILDREN'S SONG

NO MORE MATCHES FOR THIS NOTE SEQUENCE




HERE WE GO ROUND THE MULBERRY BUSH                               NOTE SEQUENCE - 13 12 14 15 16 17 18 19 20 21 13 15

THE NOTE SEQUENCES MATCH THAT OF SONG NUMBER      2
          WHITE CORAL BELLS                                                SEQUENCE - 13 12 14 15 16 17 18 19 20 21 13 15
          GIRL SCOUT SONG

THE NOTE SEQUENCES MATCH THAT OF SONG NUMBER     17
          MARY HAD A LITTLE LAMB                                           SEQUENCE - 13 12 14 15 16 17 18 19 20 21 13 15
          CHILDREN'S NURSERY RHYME

NO MORE MATCHES FOR THIS NOTE SEQUENCE
```

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