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* Project2 Part B: Melody Player
             This code plays the melody "Happy Birthday"
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* 24.10.2002
     ORG
           $4000
                          Given sample values to generate one
pulse of the sine wave
            $80,$9F,$CB,$E8,$FA,$FF,$FA,$E8,$CB
             $9F,$80,$59,$35,$19,$6,$0,$6,$18,$34,$58
     ORG $4100
                      ;Order in which notes are to be played
     FCB
             $82,$82,$74,$82,$61,$67,$82,$82,$74,$82,$56,$61
       FCB
               $82,$82,$42,$4D,$61,$67,$74,$49,$49,$4D,$61,$56,$61
     ORG
           $3100
                      ;Duration each note is to be played
     FCB
           18, 18, 36, 36, 36, 72, 18, 18, 36, 36, 36, 72
     FCB
           18, 18, 36, 36, 36, 36, 72, 18, 18, 36, 36, 36, 72
     ORG
           $3300
                      ; Hexa values of the corresponding decimal
frequency values which will be displayed (ie. Hex 598=Dec 256)
           598,598,648,598,835,804,598,598,648,598,901,835
     FDB
           598,598,1286,1074,835,804,648,1113,1113,1074,835,901,835
*_____
_____
                     ;20 samples
;Time Output Compare
;Timer Maskl
;timer Flag1
;Number = 5
N EQU $0014
TOC1 EQU $1016
TMSK1 EQU $1022
TFLG1 EQU $1023
CYCLES EQU $3700
                             ; Number of times whole of memory needs
to be accessed to make the required duration
      EQU $3900 ;Frequency or note currently being
played is stored here (25 notes altogether)
LKUP EQU $4000
                           start address of sample lookup table
LED EQU $A200 ;LED address JP8 EQU $A400 ;Port of
                     ;Port direction
             $A600
PORT1 EQU
                             ;PLD Port1 address
       ORG $3CB ;Start address of ISR. Interrupt occurs
when TCNT=TOC1.
       JMP
              ISR
       ORG
             $2000
                             ;Start of the program
     LDY
           #$3100
                          ;Start address of duration-lookup-table
                   ;Memory location where currently playing note
     STY
           $3200
from the duration-lookup-table is stored
                           ; Initialise the regirtries to zero at
first
       STAA
             FREQ
     STAA TFLG1
                     ;Set PLD PORT1 direction as OUTPUT
       STAA JP8
```

at \$3	LDX \$3 STX L1 LDX #3	CYCLES 3300 ED \$3300	;Initially CYCLES is zero ;Frequencies are stored at this memory location ;Display on LED ;Need to store address of next frequency
	STX \$		
TOC1	LDAA	#\$80	;Write #1000 0000 to TMSK1 to enable
1001	STAA TI	MSK1	;Store \$80 in TMSK1 at address 1022
	CLI		;Enable interrupts to occur
BEGIN		#N	;Load the number of samples
_	LDY	#LKUP	;Y Points to the first SAMPLE in the
	p table	0 77	TOTAL TOTAL
	LDAA	0,Y	;LOAD A with CURRENT sample from Lookup
table	STAA	PORT1	;OUTPUT DATA to PORT1
	INY	FORTI	;INC index Y to be ready for NEXT
SAMPL			, into inden 1 to be read, for Nami
	JSR	Т1	;Call DELAY subroutine
	DEX		;DEC X
	BEQ	BEGIN	;IF $X=0$, ONE Cycle finishes and next
cycle	starts		
	JMP	LOOP1	Otherwise, OUTPUT next SAMPLE
4			
~			
* DEL	AY SUBRU	rine:	
* DEL T1	AY SUBRU' PSHY	rine:	Record Y in a Stack so the register;
T1	PSHY	TINE: n this sub	
T1 can b	PSHY e used in LDY	n this sub #\$4100	
T1 can b	PSHY e used in	n this sub #\$4100 up table	routine ;Load Y with the starting address of
T1 can b	PSHY e used in LDY one lookt LDAB	n this sub #\$4100	;Load Y with the starting address of ;Load ACCB with tone number
T1 can b	PSHY e used in LDY one look LDAB ABY	n this sub #\$4100 up table FREQ	;Load Y with the starting address of ;Load ACCB with tone number ;Add it to Y to get the current address
T1 can b	PSHY oe used in LDY one looku LDAB ABY oe tone lo	n this sub #\$4100 up table FREQ	;Load Y with the starting address of ;Load ACCB with tone number ;Add it to Y to get the current address
T1 can b the t	PSHY oe used in LDY one looku LDAB ABY oe tone lo	n this sub #\$4100 up table FREQ	;Load Y with the starting address of ;Load ACCB with tone number ;Add it to Y to get the current address e ;Get current tone repeat value
T1 can b the t of th	PSHY oe used in LDY one looks LDAB ABY oe tone lo LDAA DECA	this sub #\$4100 up table FREQ bokup tabl \$0,Y	;Load Y with the starting address of ;Load ACCB with tone number ;Add it to Y to get the current address
T1 can b the t of th	PSHY oe used in LDY one looku LDAB ABY oe tone lo	this sub #\$4100 up table FREQ bokup tabl \$0,Y	;Load Y with the starting address of ;Load ACCB with tone number ;Add it to Y to get the current address e ;Get current tone repeat value
T1 can b the t of th	PSHY De used in LDY ONE looks LDAB ABY DECA CCT time (n this sub #\$4100 up table FREQ bookup tabl \$0,Y	;Load Y with the starting address of ;Load ACCB with tone number ;Add it to Y to get the current address e ;Get current tone repeat value ;start time delay loop to get the
T1 can b the t of th L1 corre	PSHY De used in LDY One looks LDAB ABY DECA DECA Ct time of BNE PULY	n this sub #\$4100 up table FREQ bookup tabl \$0,Y delay L1	;Load Y with the starting address of ;Load ACCB with tone number ;Add it to Y to get the current address e ;Get current tone repeat value
T1 can b the t of th L1 corre	PSHY De used in LDY One looks LDAB ABY DE tone lo LDAA DECA OCT time of BNE	n this sub #\$4100 up table FREQ bookup tabl \$0,Y delay L1	;Load Y with the starting address of ;Load ACCB with tone number ;Add it to Y to get the current address e ;Get current tone repeat value ;start time delay loop to get the
T1 can b the t of th L1 corre	PSHY De used in LDY ONE looks LDAB ABY DECA COLUMN COLUMN DECA COL	n this sub #\$4100 up table FREQ DOKUP tabl \$0,Y delay L1	;Load Y with the starting address of ;Load ACCB with tone number ;Add it to Y to get the current address e ;Get current tone repeat value ;start time delay loop to get the ;Recall Y from Stack before returning ;Return from Subroutine
T1 can b the t of th L1 correto ma	PSHY De used in LDY ONE looks LDAB ABY DECA Ct time of BNE PULY IN progra RTS	this sub #\$4100 up table FREQ bokup tabl \$0,Y delay L1	;Load Y with the starting address of ;Load ACCB with tone number ;Add it to Y to get the current address e ;Get current tone repeat value ;start time delay loop to get the ;Recall Y from Stack before returning ;Return from Subroutine
T1 can b the t of th L1 correto ma	PSHY De used in LDY ONE looks LDAB ABY DECA Ct time of BNE PULY IN progra RTS	this sub #\$4100 up table FREQ bokup tabl \$0,Y delay L1	;Load Y with the starting address of ;Load ACCB with tone number ;Add it to Y to get the current address e ;Get current tone repeat value ;start time delay loop to get the ;Recall Y from Stack before returning ;Return from Subroutine
T1 can b the t of th L1 corre to ma	PSHY De used in LDY ONE looks LDAB ABY DECA Ct time of BNE PULY IN progra RTS	this sub #\$4100 up table FREQ bokup tabl \$0,Y delay L1	;Load Y with the starting address of ;Load ACCB with tone number ;Add it to Y to get the current address e ;Get current tone repeat value ;start time delay loop to get the ;Recall Y from Stack before returning ;Return from Subroutine
T1 can b the t of th L1 corre to ma * * Int	PSHY oe used in LDY one looku LDAB ABY e tone lo LDAA DECA ct time of BNE PULY in progra RTS errupt Sa	this sub #\$4100 up table FREQ bokup tabl \$0,Y delay L1 am	;Load Y with the starting address of ;Load ACCB with tone number ;Add it to Y to get the current address e ;Get current tone repeat value ;start time delay loop to get the ;Recall Y from Stack before returning ;Return from Subroutine
T1 can be the to the	PSHY De used in LDY ONE looks LDAB ABY DECA Ct time of BNE PULY IN progra RTS errupt Sa	this sub #\$4100 up table FREQ bokup tabl \$0,Y delay L1 am	;Load Y with the starting address of ;Load ACCB with tone number ;Add it to Y to get the current address e ;Get current tone repeat value ;start time delay loop to get the ;Recall Y from Stack before returning ;Return from Subroutine time ;Initially #\$3100 is stored in \$3200. This is
T1 can be the to the	PSHY De used in LDY ONE looks LDAB ABY DECA Ct time of BNE PULY IN progra RTS errupt Sa	this sub #\$4100 up table FREQ bokup tabl \$0,Y delay L1 am	;Load Y with the starting address of ;Load ACCB with tone number ;Add it to Y to get the current address e ;Get current tone repeat value ;start time delay loop to get the ;Recall Y from Stack before returning ;Return from Subroutine
T1 can b the t of th L1 corre to ma * * Int ISR updat	PSHY De used in LDY ONE looks LDAB ABY DECA OCT time of BNE PULY IN progra RTS errupt Se LDY \$: ed and re	n this sub #\$4100 up table FREQ bokup tabl \$0,Y delay L1 am ervice Rou 3200 elevant me #\$FFFF	;Load Y with the starting address of ;Load ACCB with tone number ;Add it to Y to get the current address e ;Get current tone repeat value ;start time delay loop to get the ;Recall Y from Stack before returning ;Return from Subroutine tine ;Initially #\$3100 is stored in \$3200. This is mory accessed to get duration
T1 can b the t of th L1 corre to ma * * Int ISR updat all m	PSHY De used in LDY ONE looks LDAB ABY DECA COLUMN	n this sub #\$4100 up table FREQ bokup tabl \$0,Y delay L1 am ervice Rou 3200 elevant me #\$FFFF	;Load Y with the starting address of ;Load ACCB with tone number ;Add it to Y to get the current address ;Get current tone repeat value ;start time delay loop to get the ;Recall Y from Stack before returning ;Return from Subroutine tine ;Initially #\$3100 is stored in \$3200. This is mory accessed to get duration ;It takes 0.016384 seconds to access ;add \$FFFF to TOC1, so after 0.016384

```
;Stored in TOC1 so as to check when
        STD
                TOC1
next whole cycle finishes
        LDAA
                CYCLES
                                ;ACCA has the number of times whole of
memory (65535) has been accessed
        INCA
                                ;then increase it
        STAA
                CYCLES
                              ;Updated value stored
        CMPA
                0,Y
                              ; Compare if number in ACCA is equal to
duration given by (0,Y). Initially it will be (0,$3100)
               DONE
                                ; Checks if duration is reached or not
       BNE
      INY
                        ; If equal next note and duration have to be
accessed
            $3200
                        ; Value in Y stored so that next duration can be
     STY
accessed with the next note
     LDAA
              FREO
                              ;Load ACCA with the number of notes that
have been played (25 altogether)
        TNCA
     PSHA
                        ;This section creates a slight delay of around
0.4s so that theres a slight pause between 2 notes
     LDAA #25
                       ;Two loops are used. Outer loop is 0.016384
seconds ($FFFF loop) and the inner runs 25 times.
     LDAB #$FFFF
                              ; therefore delay is 0.01634 * 25 = 0.4096
secs
            DECB
DELAY
     DECA
SM
     BNE
            SM
     CMPB #0
     BNE
           DELAY
     PULA
                        ;This section displays the dec value of the
     PSHY
frequency being played, on the LED display
            $3400
                      ;Access frequency to display
     LDX
     LDY
            0,X
     STY
           LED
                        ;Display to LED's
      INX
      INX
      STX
            $3400
                        ;Store address of next frequency location
     PULY
                        ;Restore Y
        STAA
                              ;Updated number of notes that have been
                FREO
played, stored
                                ; Checks if all 25 notes have been
        CMPA
                #25
played
        BNE
                START
                                ; If not end of tones continue with next
tone
     LDY
            #$3100
                              ; End of tones. Start loading durations
again from $3100
                        ;Point to beginning of duration-look-up table
     STY
            $3200
     LDY
            $3300
                        ; This bit of code initialises the LED's at the
end of one melody cycle
     STY
           LED
     LDY
            #$3302
      STY
            $3400
```

; End of playing 25 tones. Start from the CLRA beginning FREQ ;Updated number of tones stored at \$3900 STAA START CLRA ; End of 1 tone, but not end of tonelook-up table ;Start CYCLES from zero STAA CYCLES LDX #\$1000 ;Needed later for BCLR TFLG1,x \$7F ;This need to be cleared to enable BCLR interrupt in the next cycle RTI Return from ISR END *----END OF PART B----