

Application Programs

ELEC 330

Digital Systems Engineering

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Images Courtesy of Ramesh Gaonkar and Delmar Learning



Application Programs

- ◆ BCD to Binary Conversion
- ◆ Binary to BCD Conversion
- ◆ ASCII Code to Binary Conversion
- ◆ Binary to ASCII Code Conversion
- ◆ Multiplication of 16-bit Numbers
- ◆ Division of Two Unsigned Numbers

BCD to Binary Conversion

- ◆ Data often entered in decimal format
- ◆ A through F are invalid
- ◆ Special care taken to process the data in BCD
 - Sometimes necessary to convert the BCD data into binary numbers

BCD to Binary Conversion

- ◆ Problem statement
 - Given a packed BCD number in WREG
 - Write a subroutine to unpack the number
 - Convert it into its equivalent binary number
 - Return the number in WREG

BCD to Binary Conversion

- ◆ Problem analysis
 - The BCD numbers include only ten digits from 0 to 9
 - The value of the digit is based on its position
 - Example, in decimal number 97, the value of 9 is 90
 - To find the binary value of $97_{\text{BCD}} = 1001\ 0111$
 - Unpack the number
 - ◆ 9 (00001001) and 7 (00000111)
 - Multiply high-order digit by 10 and add low-order digit
 - ◆ $(00001001) \times 10 + (0000111)$

Unpack

Opcode	Operands	Comments
MOVWF	REG1	;Save BCD
ANDLW	0x0F	;Mask high digit
MOVWF	BCD0	;Save low digit
MOVF	REG1,W	;Get saved BCD
SWAPF	WREG,W	;Swap digits
ANDLW	0x0F	;Mask low digit
MOVWF	BCD1	;Save high digit

Convert

Opcode	Operands	Comments
MULLW	D'10'	;Multiply high digit
MOVFF	PRODL,WREG	;Move product
ADDWF	BCD0,W	;Add low digit
RETURN		

PIC18 Simulator

PIC18 Simulator IDE

File Simulation Rate Tools Options Help STEP

Program Location: C:\Hayne\ELEC330\Examples\Ch08\IP8-1.hex

Microcontroller: PIC18F452 Clock Frequency: 8.0 MHz

Last Instruction: Next Instruction: **GOTO 0x000020**

Instructions Counter: 0 Clock Cycles Counter: 4

Program Counter and Working Register

PC: 000000

W Register (WREG): 48

Real Time Duration: 0.50 μ s

Special Function Registers (SFRs)

Address and Name	Hex Value	Binary Value
		7 6 5 4 3 2 1 0
FFFh TOSU	00	
FFEh TOSH	00	
FFDh TOSL	00	
FFCh STKPTR	00	
FFBh PCLATU	00	
FFAh PCLATH	00	
FF9h PCL	00	
FF8h TBLPTRU	00	
FF7h TBLPTRH	00	
FF6h TBLPTRL	00	
FF5h TABLAT	00	
FF4h PRODH	00	
FF3h PRODL	00	
FF2h INTCON1	00	
FF1h INTCON2	F5	
FF0h INTCON3	C0	

General Purpose Registers (GPRs)

Addr.	Hex Value	Addr.	Hex Value
000h	00	010h	00
001h	00	011h	00
002h	00	012h	00
003h	00	013h	00
004h	00	014h	00
005h	00	015h	00
006h	00	016h	00
007h	00	017h	00
008h	00	018h	00
009h	00	019h	00
00Ah	00	01Ah	00
00Bh	00	01Bh	00
00Ch	00	01Ch	00
00Dh	00	01Dh	00
00Eh	00	01Eh	00
00Fh	00	01Fh	00