Quiz 3

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Quiz3-2020

SIMON FRASER UNIVERSITY
School of Mechatronic Systems Engineering
MSE 352 Digital Logic and Microcontrollers
Quiz III – Fall 2020

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1. The following code snippet shows a delay function created by a loop in 8051. It is also shown that how many machine cycles needs to execute an instruction.
   If the #Delay is 230 (decimal), and each machine cycle takes 1.085 μsec, what would be the created delay time? **[5 Marks]**

```
DELAY:MOV R3,#Delay   ; 1 machine cycle
HERE: NOP             ; 1 machine cycle
      NOP             ; 1 machine cycle
      DJNZ R3, HERE   ; 2 machine cycle
      RET             ; 2 machine cycle
```

NOP : means No Operation, that is nothing is done by an MCU.

$$\left[230\,(1+1+2)\;+1\;+2\right]1.085\,\mu sec \;=\; 1001.455\,\mu s$$

2. Explain the difference of the following addressing modes with an example.
   i) Indirect Addressing Mode **[2.5 Marks]**
   ii) Indexed Addressing Mode **[2.5 Marks]**

i) Indirect addressing mode will load the value from the address location which equals the pointer value
eg. MOV @R0 , A → moves contents of A to address R0 points to

ii) Indexed addressing mode is used for accessing data from look-up table entries located in the ROM
eg. MOVC A , @A + DPTR
↳ content of this location is stored in A

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ARITHMETIC OPERATORS

Instruction	Description	Bytes	Periods	C	OV	AC
ADD A, Rn	Add register to ACC	1	12	x	x	x
ADD A, direct	Add direct byte to ACC	2	12	x	x	x
ADD A, @Ri	Add indirect RAM to ACC	1	12	x	x	x
ADD A, #data	Add immediate data to ACC	2	12	x	x	x
ADDC A, Rn	Add register to ACC with Carry	1	12	x	x	x
ADDC A, direct	Add direct byte to ACC with Carry	2	12	x	x	x
ADDC A, @Ri	Add indirect RAM to ACC with Carry	1	12	x	x	x
ADDC A, #data	Add immediate data to ACC with Carry	2	12	x	x	x
SUBB A, Rn	Subtract Register from ACC with borrow	1	12	x	x	x
SUBB A, direct	Subtract indirect RAM from ACC with borrow	2	12	x	x	x
SUBB A, @Ri	Subtract indirect RAM from ACC with borrow	1	12	x	x	x
SUBB A, #data	Subtract immediate data from ACC with borrow	2	12	x	x	x
INC A	Increment ACC	1	12			
INC Rn	Increment register	1	12			
INC direct	Increment direct byte	2	12			
INC @Ri	Increment direct RAM	1	12			
DEC A	Decrement ACC	1	12			
DEC Rn	Decrement Register	1	12			
DEC direct	Decrement direct byte	2	12			
DEC @Ri	Decrement indirect RAM	1	12			
INC DPTR	Increment Data Pointer	1	24			
MUL AB	Multiply A & B	1	48	0	x	
DIV AB	Divide A by B	1	48	0	x	
DA A	Decimal Adjust ACC	1	12	x		

Instruction	Description	Bytes	Periods	C	OV	AC
ANL A,Rn	AND register to ACC	1	12			
ANL A,direct	AND direct byte to ACC	2	12			
ANL A,@Ri	AND indirect RAM to ACC	1	12			
ANL A,#data	AND immediate data to ACC	2	12			
ANL direct,A	AND ACC to direct byte	2	12			
ANL direct,#data	AND immediate data to direct byte	3	24			
ORL A,Rn	OR register to ACC	1	12			
ORL A,direct	OR direct byte to ACC	2	12			
ORL A,@Ri	OR indirect RAM to ACC	1	12			
ORL A,#data	OR immediate data to ACC	2	12			
ORL direct,A	OR ACC to direct byte	2	12			
ORL direct,#data	OR immediate data to direct byte	3	24			
XRL A,Rn	XOR register to ACC	1	12			
XRL A,direct	XOR direct byte to ACC	2	12			
XRL A,@Ri	XOR indirect RAM to ACC	1	12			
XRL A,#data	XOR immediate data to ACC	2	12			
XRL direct,A	XOR ACC to direct byte	2	12			
XRL direct,#data	XOR immediate data to direct byte	3	24			
CLR A	Clear the ACC	1	12			
CPL A	Complement the ACC	1	12			
RL A	Rotate the ACC left	1	12			
RLC A	Rotate the ACC left through Carry	1	12	x		
RR A	Rotate the ACC right	1	12			
RRC A	Rotate the ACC right through Carry	1	12	x		
SWAP A	Swap nibbles in the ACC	1	12			