|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **8a. Design and develop an assembly program to demonstrate BCD Up-Down Counter (00-99) on the Logic Controller Interface** | | | | | | |
| **LABEL** | **NEMONIC** | **OPERAND (MEMORY/REGISTER)** | | |  | **COMMENTS** |
|  | **.MODEL** | **SMALL** | | | **;** |  |
|  | **.DATA** |  | | | **;** |  |
| **PA** | **EQU** | **01080H** | | | **;** | **ADDRESS OF PORT A** |
| **PB** | **EQU** | **01081H** | | | **;** | **ADDRESS OF PORT B** |
| **PC** | **EQU** | **01082H** | | | **;** | **ADDRESS OF PORT C** |
| **CTRL** | **EQU** | **01083H** | | | **;** | **ADDRESS OF CONTROL WORD** |
|  | **.CODE** |  | | | **;** |  |
|  | **MOV** | **AX** | **,** | **@DATA** | **;** | **INITIALIZATION OF DATA SEGMENT** |
|  | **MOV** | **DS** | **,** | **AX** | **;** |  |
|  |  |  |  |  |  |  |
|  | **MOV** | **AL** | **,** | **80H** | **;** | **INITIALIZATION OF 8255 CONTROL WORD** |
|  | **MOV** | **DX** | **,** | **CTRL** | **;** |  |
|  | **OUT** | **DX** | **,** | **AL** | **;** |  |
|  |  |  |  |  |  |  |
|  | **MOV** | **CX** | **,** | **99** | **;** | **INITIALIZE CX TO UP-COUNT 0 TO 15** |
|  | **MOV** | **AL** | **,** | **00H** | **;** |  |
|  |  |  |  |  |  |  |
| **NXT\_UP:** | **MOV** | **DX** | **,** | **PORTA** | **;** | **SEND THE COUNT VALUE ON PORT A** |
|  | **OUT** | **DX** | **,** | **AL** | **;** |  |
|  | **CALL** | **DELAY** |  |  | **;** | **CALL DELAY TO VIEW THE COUNT ON INTERFACE** |
|  | **ADD** | **AL** | **,** | **01** | **;** | **UPDATE THE UP COUNTER BY ONE** |
|  | **DAA** |  |  |  | **;** | **ADJUST TO BCD VALUE** |
|  | **LOOP** | **NXT\_UP** |  |  | **;** | **LOOP NEXT VALUE** |
|  |  |  |  |  |  |  |
|  | **MOV** | **CX** | **,** | **99** |  | **INITIALIZE CX TO DOWN-COUNT 15 TO 0** |
| **NXT\_DW:** | **MOV** | **DX** |  | **PORTA** | **;** | **SEND THE COUNT VALUE ON PORT A** |
|  | **OUT** | **DX** |  | **AL** |  |  |
|  | **SUB** | **AL** |  | **01** |  | **UPDATE THE DOWN COUNTER BY ONE** |
|  | **DAS** |  |  |  |  | **ADJUST TO BCD VALUE** |
|  | **CALL** | **DELAY** |  |  | **;** | **CALL DELAY TO VIEW THE COUNT ON INTERFACE** |
|  | **LOOP** | **NXT\_DW** |  |  | **;** | **LOOP NEXT VALUE** |
|  |  |  |  |  | **;** |  |
|  | **INT** | **3H** |  |  |  | **CONTROL BREAK POINT** |
|  |  |  |  |  |  |  |
| **DELAY** | **PROC** |  |  |  | **;** | **DELAY PROCEDURE TO ELAPSE TIME** |
|  | **PUSH** | **CX** |  |  |  | **SAVE THE CONTENTS OF CX** |
|  |  |  |  |  |  |  |
|  | **MOV** | **CX** | **,** | **0FH** | **;** | **SET OUTER LOOP COUNT** |
| **OUTER:** | **PUSH** | **CX** |  |  | **;** |  |
|  |  |  |  |  | **;** |  |
|  | **MOV** | **CX** |  | **0FFFFH** |  | **SET INNER LOOP COUNT** |
| **INNER:** | **NOP** |  |  |  | **;** | **NO OPERATION INSTRUCTIONS** |
|  | **NOP** |  |  |  | **;** |  |
|  | **NOP** |  |  |  | **;** |  |
|  | **LOOP** | **INNER** |  |  | **;** | **GOTO INNER** |
|  |  |  |  |  |  |  |
|  | **POP** | **CX** |  |  | **;** |  |
|  | **LOOP** | **OUTER** |  |  | **;** | **GOTO OUTER** |
|  |  |  |  |  |  |  |
|  | **POP** | **CX** |  |  |  | **RESTORE THE CONTENTS OF CX** |
|  |  |  |  |  |  |  |
|  | **RET** |  |  |  | **;** | **RETUREN TO CALLING PROCEDURE** |
| **DELAY** | **ENDP** |  |  |  | **;** | **END OF PROCEDURE** |
|  |  |  |  |  |  |  |
|  | **END** |  |  |  | **;** | **END OF PROGRAM** |

**OUTPUT**

* **Edit filename.asm**
* **Masm filename.asm;**
* **Link filename;**
* **allowio 0x1080H**
* **Debug filename.exe**

**on Logical Controller Interface PORT A**

**UP COUNTER**

**00 -- 0000 0000**

**01 -- 0000 0001**

**.**

**.**

**.**

**10 -- 0001 0000**

**.**

**.**

**.**

**99 -- 1001 1001**

**DOWN COUNTER**

**98 -- 1001 1000**

**97 -- 1001 0111**

**.**

**.**

**.**

**.**

**.**

**00 -- 0000 0000**