University *of* Alexandria
Faculty of Engineering
Division of Communications & Electronics

Subject Name: Microcontrollers **Lecturers:** Dr. M. El-Banna and Dr. H. Farag
Academic Year: 2026 – 2027 **Assistant:** Eng. TBD

Microcontrollers Sheet

1. **What is the difference between Flash, EEPROM, and RAM in PIC?**
2. **What is the difference between Harvard and Von Neumann architecture?**
3. **What are the steps for handling an interrupt?**
4. **What is the difference between polling and interrupt?**
5. **Write a comment beside each instruction to explain what it does and figure out what the overall code intends to do:**

```
        ORG 000
        BSF  3,5
        CLRW
        MOVWF  86
        BCF  3,5
        MOVLW  55
AGAIN   MOVWF  06
        GOTO  AGAIN
        END
```

6. **To store 00 into file registers number 00 – to – 2C, one can write the following code to do it:**

```
        CLRF  08
        CLRF  09
          .
          .
        CLRF 2C
```

Write a code to do the same using the indirect addressing mode

7. **Calculate the delay in instructions per second of the following loop, the clock frequency is 32 kHz**

```
            ORG   000
            BSF 3,5
            CLRW
            MOVWF 86
            BCF 3,5
            MOVLW 55
            MOVWF 06
 AGAIN      INCF 06,1
            MOVLW 30
            MOVWF  20
 COUNT      DECFSZ 20,1
GOTO        COUNT
GOTO        AGAIN
END
```

University *of* Alexandria
Faculty of Engineering
Division of Communications & Electronics

Subject Name: Microcontrollers **Lecturers:** Dr. M. El-Banna and Dr. H. Farag
Academic Year: 2026 – 2027 **Assistant:** Eng. TBD

Microcontrollers Sheet

1. **What is the difference between Flash, EEPROM, and RAM in PIC?**
   - **Flash**: Stores the program permanently (non-volatile).
   - **EEPROM**: Stores data permanently but can be modified at runtime.
   - **RAM**: Temporary storage for data and program execution.

2. **What is the difference between Harvard and Von Neumann architecture?**
   - **Harvard:** Separate memory for program and data.
   - **Von Neumann:** A single memory for both program and data.

3. **What are the steps for handling an interrupt?**
   a. Enable Global Interrupts (GIE).
   b. Enable specific peripheral/external interrupts.
   c. Set Interrupt Service Routine (ISR).
   d. Configure priority (if applicable).

4. **What is the difference between polling and interrupt?**
   - **Polling:** The CPU continuously checks a flag.
   - **Interrupts:** CPU gets notified only when an event occurs.

5. **Write a comment beside each instruction to explain what it does and figure out what the overall code intends to do:**

```
ORG 000  ; start coding at address 000
BSF  3,5    ; go to bank 1
CLRW       ; cleat working register W = 0
MOVWF  86   ; place 0's in file register TRISB,  making all  PB's pins output
BCF  3,5          ; back to bank 0
MOVLW  55      ; store 01010101 in W
```

```
AGAIN   MOVWF  06  ; output 01010101 to PB's turn ON and OFF LEDs sequentially
                    ;  and this is what the code does
        GOTO  AGAIN
        END
```

6. **To store 00 into file registers number 00 – to – 2C, one can write the following code to do it:**

```
        CLRF  08
        CLRF  09
          .
          .
        CLRF 2C
```

Write a code to do the same using the indirect addressing mode

```
        MOVLW    0x09
        MOVWF    FSR
LOOP    CLRF     INDF
        INCF     FSR, F
        MOFWF    FSR,W
        SUBLW    0x2C
        BTFSS    STATUS,3
        GOTO     LOOP
         [ Next Instruction ]
```

7. **Calculate the delay in instructions per second of the following loop, the clock frequency is 32 kHz**

```
            ORG   000
            BSF 3,5
            CLRW
            MOVWF 86
            BCF 3,5
            MOVLW 55
            MOVWF 06
 AGAIN      INCF 06,1
            MOVLW 30
            MOVWF  20
 COUNT      DECFSZ 20,1
GOTO        COUNT
GOTO        AGAIN
```

END

Starting from the moment that PortB is incremented:
MOVLW takes 1 count.
MOVWF takes 1 count.
DECFSZ takes 1 count normally but 2 when it leaves the loop.
As the register was loaded with hex number 30, which is 48 in decimal, it will go around the 'count' loop 47 times at 1 instruction clock each and 2 clocks as it leaves the loop.
This gives a total of 49 cycles.
goto will be used 48 times at 2 clocks each giving a total of 96 clocks.
goto will also be used once to return to the PortB, this is another 2 cycles.
Finally, INCF takes 1 count to increment the value on PortB.
The total is: 1 + 1 + 49 + 48 + 2 + 1 = 102 cycles
Assuming a crystal frequency of 32kHz, we can divide it by 4 to give the instruction clock frequency and then by the delay of 102 cycles to give the rate at which the PortB is incremented of about 78 counts per second.
PortB counts in binary from 0000 0000 to 1111 1111 and will finish its count after 256 counts so it will start recounting after 256/78 or roughly 3.3 seconds.