Tutorial exercises No 7

Exercise 01:

Course Questions

1. Determine the command words (in mode 0) to write into the command register of the 8255A PPI for the following configurations:
   a) PORTA as input, PORTB as input, and PORTC as output.
   b) PORTA as output, PORTB as input, and PORTC as input.
   c) PORTA as input, PORTB as output, PORTC (lower) as output, and PORTC (upper) as input.
2. Determine the states of signals **A1**, **A0**, **RD**, **WR**, and **CS** for:
   a) Reading from PORTA.
   b) Writing to the command register (Reg_Com).
3. If the command register contains the value **99H**:

   Determine the configuration of the ports (input or output) of the 8255A and the mode being used.

Exercise 02:

Create the flowchart and write an assembly program to display numbers from 0 to 15 on a 7-segment display. Each number is displayed for 1 second (using a 1-second delay). The address of PORTA is **200H**. Mode 0 is used to program the PPI. PORTB and the upper part of PORTC are not connected and must be configured as outputs.

The display used is a common anode 7-segment display with 2 digits, multiplexed. The units digit is selected via transistor **Q1**, and the tens digit is selected via transistor **Q2**. A **7447 BCD-to-7-segment decoder** is used to drive the display. See the circuit diagram below.

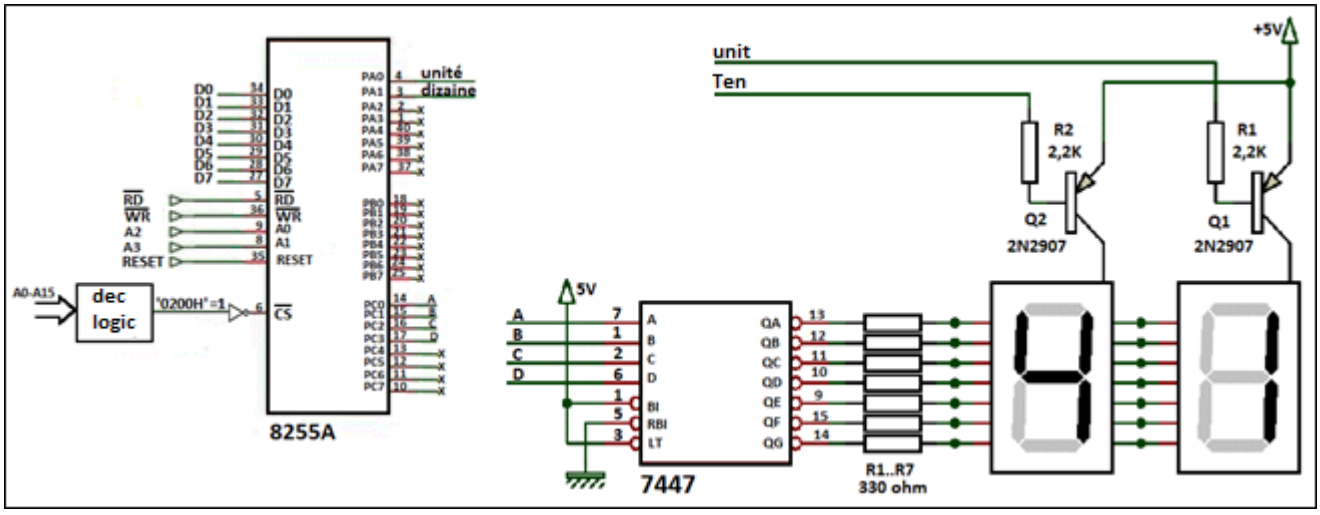

Figure 7.1. Interface Diagram for a 7-Segment Display

Exercise 03:

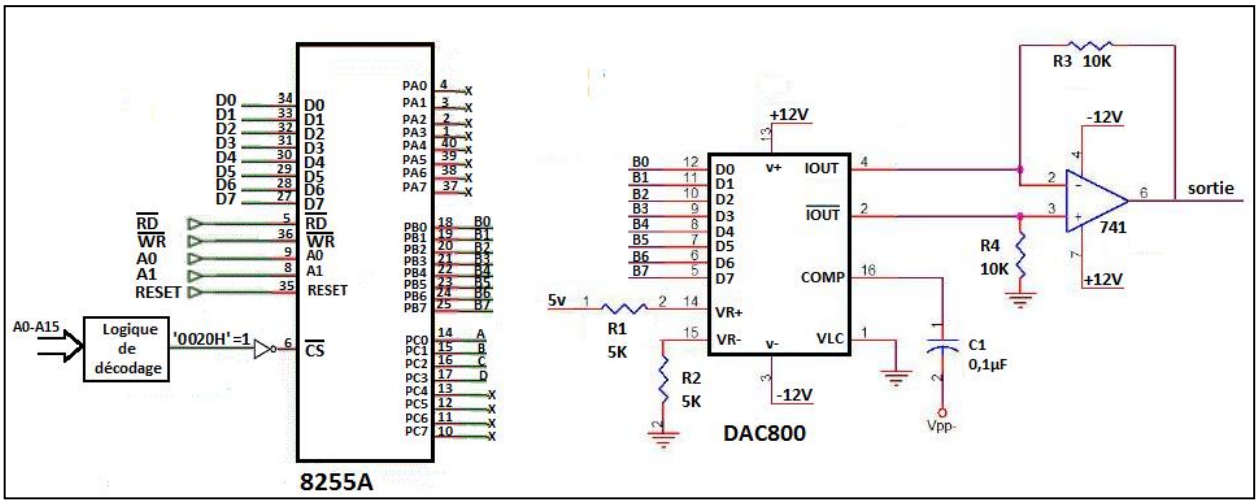

Figure 7.2. Interface Diagram for the Digital-to-Analog Converter DAC800

Create the flowchart and write a program to generate a triangular signal with a period of 60 ms. The main program uses a 0.5 ms delay subroutine (tempo). The ports (**PORTA** and **PORTB**) are not connected and must be configured as outputs. The 8255A is configured in mode 0.

Exercise 04:

In the diagram below, a 16-key keypad is used, organized in a 4x4 matrix of push buttons. A 8255A PPI is used to interface it with the 8086. The lines of **PORTC** are connected to the columns, and the lines of **PORTA** are connected to the rows.

- **PORTC** is configured as output, and **PORTA** as input.
- The 8255 sequentially sets each line of its output to logic "1". If a key is pressed, the corresponding column will then go to logic "1". Knowing which row is at logic "1", the pressed key in the matrix can be identified.

Write a program to identify the pressed key.

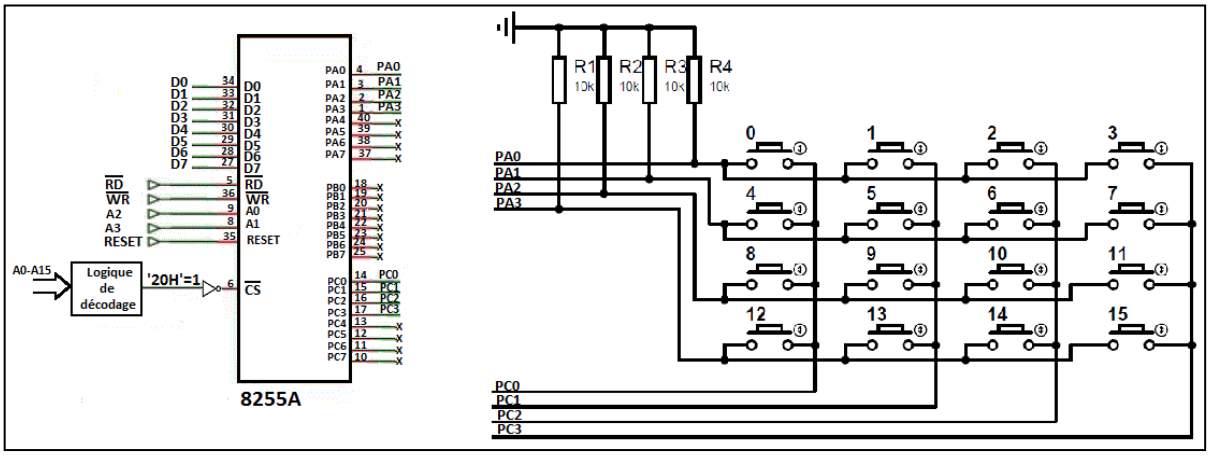

Figure 7.3. Interface Diagram of a 4x4 16-Key Keypad

Exercise 05:

Create the flowchart and write a program to control a two-phase unipolar stepper motor. The motor should rotate in the clockwise direction (operating in full-step mode with maximum torque). (See the figure below.)

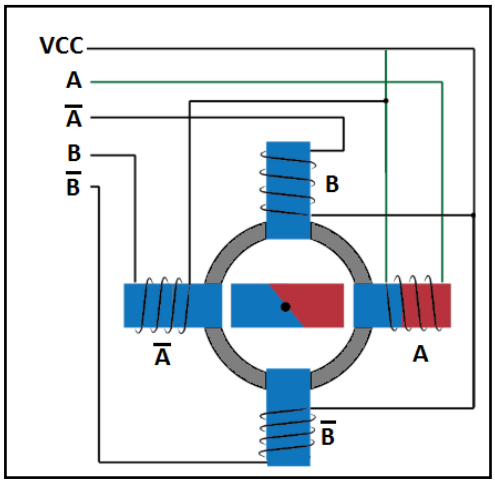

Figure 7.4. Two-Phase Unipolar Stepper Motor

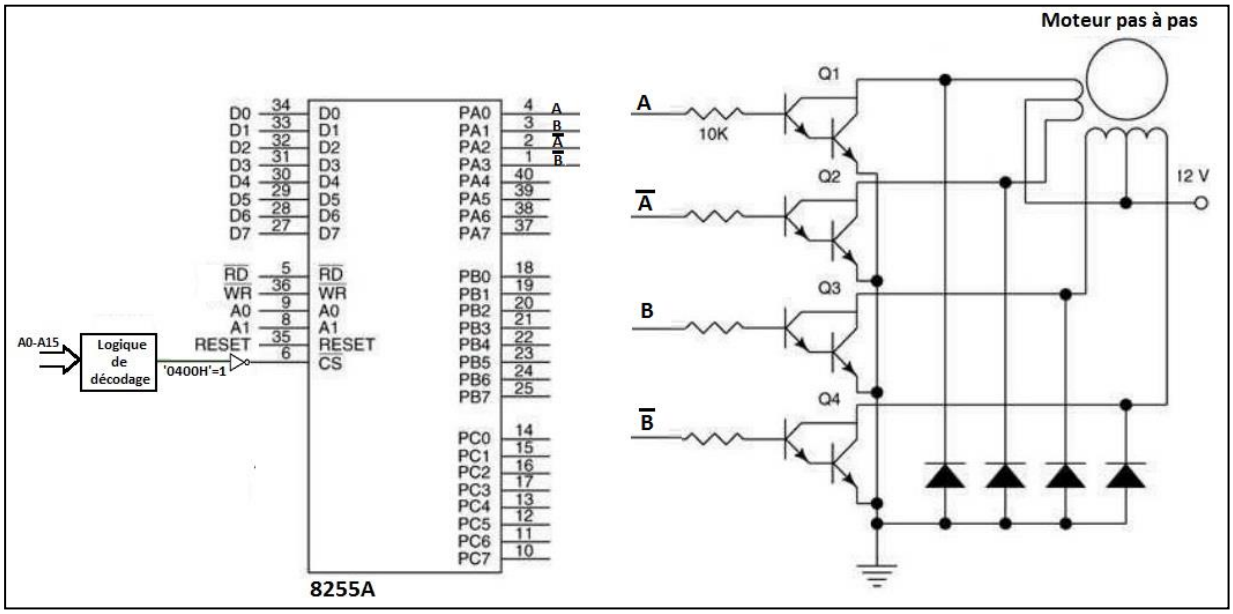

Figure 7.5. Interface Diagram of the Stepper Motor