Introduction to 8085 Instructions

Example 6.2:

Write instructions to read eight ON/OF switches connected to the address 00H, and turn on the devices connected to the output port with the address 01H, as shown in Figure 6.1. (I/O port addresses are given in hexadecimal.)

Solution:

The input has eight switches that are connected to the data bus through the tri-state buffer. Any one of the switches can be connected to +5V (logic 1) or to ground (logic 0), and each switch controls the corresponding device at the output port.
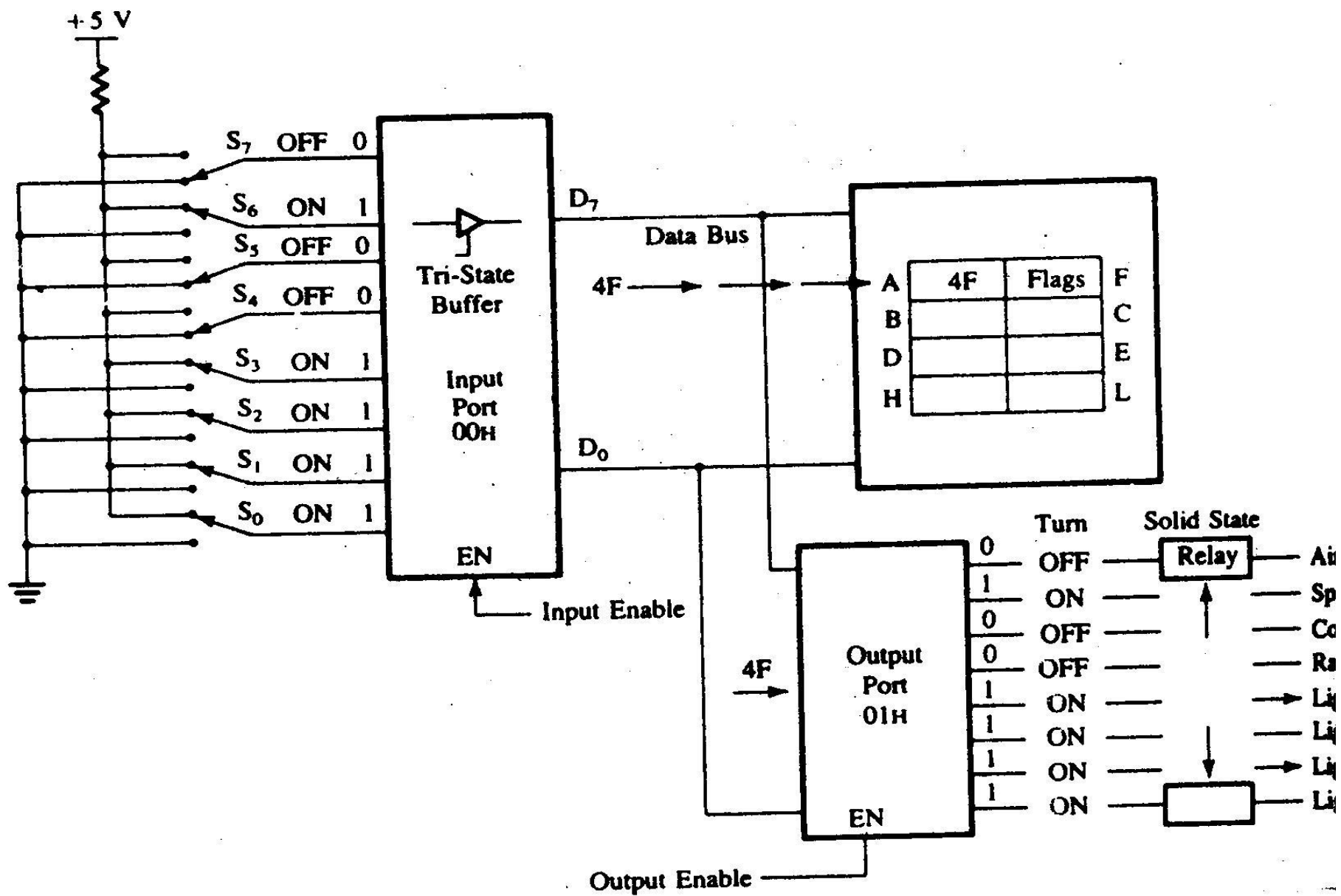
Instructions

```
IN    00H
OUT   01H
HLT
```

FIGURE 6.1
Reading Data at Input Port and Sending Data to Output Port

Example 6.8:

In Figure 6.8, keep the radio on (D_4) continuously without affecting the functions of other appliances, even if someone turns off the switch S_4.

## Solution

The bit D_4 should be set by Oring the input port with data byte 10H as follows:

$$
\begin{array}{llcccccccc}
\text{IN 00H :} & (A) = & D_7 & D_6 & D_5 & D_4 & D_3 & D_2 & D_1 & D_0 \\
\text{ORI 10H :} & = & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
\hline
& (A) = & D_7 & D_6 & D_5 & 1 & D_3 & D_2 & D_1 & D_0
\end{array}
$$

In Figure 6.8, assume it is winter, and turn off the air conditioner without affecting the other appliances,

$$
\begin{array}{llcccccccc}
\text{IN 00H :} & (A) = & D_7 & D_6 & D_5 & D_4 & D_3 & D_2 & D_1 & D_0 \\
\text{ANI 7FH :} & = & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \\
\hline
& (A) = & 0 & D_6 & D_5 & D_4 & D_3 & D_2 & D_1 & D_0
\end{array}
$$
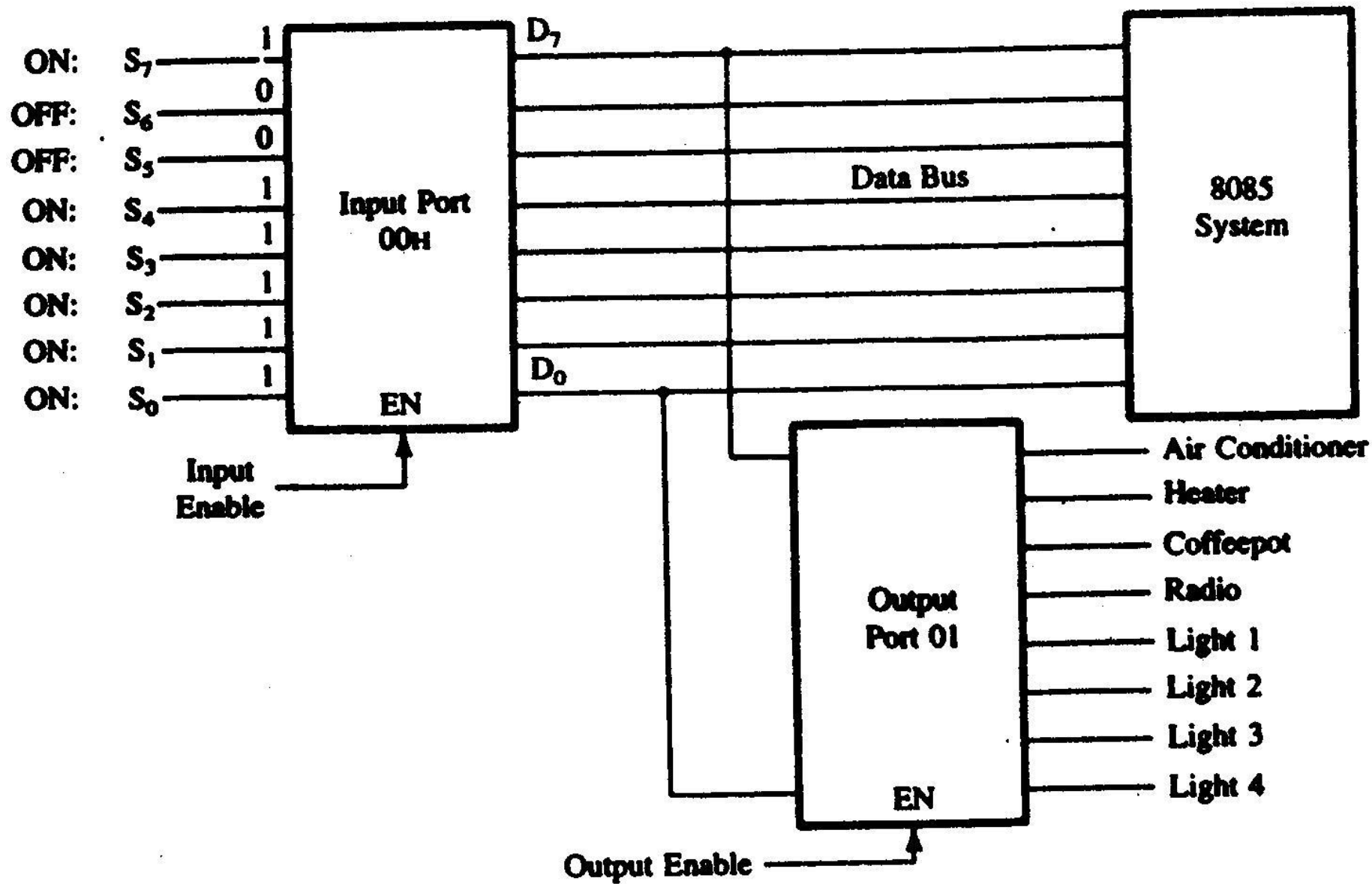
FIGURE 6.8
Input Port to Control Appliances

6.35 Illustrative Program: <u>ORing Data from Two Input Ports</u>
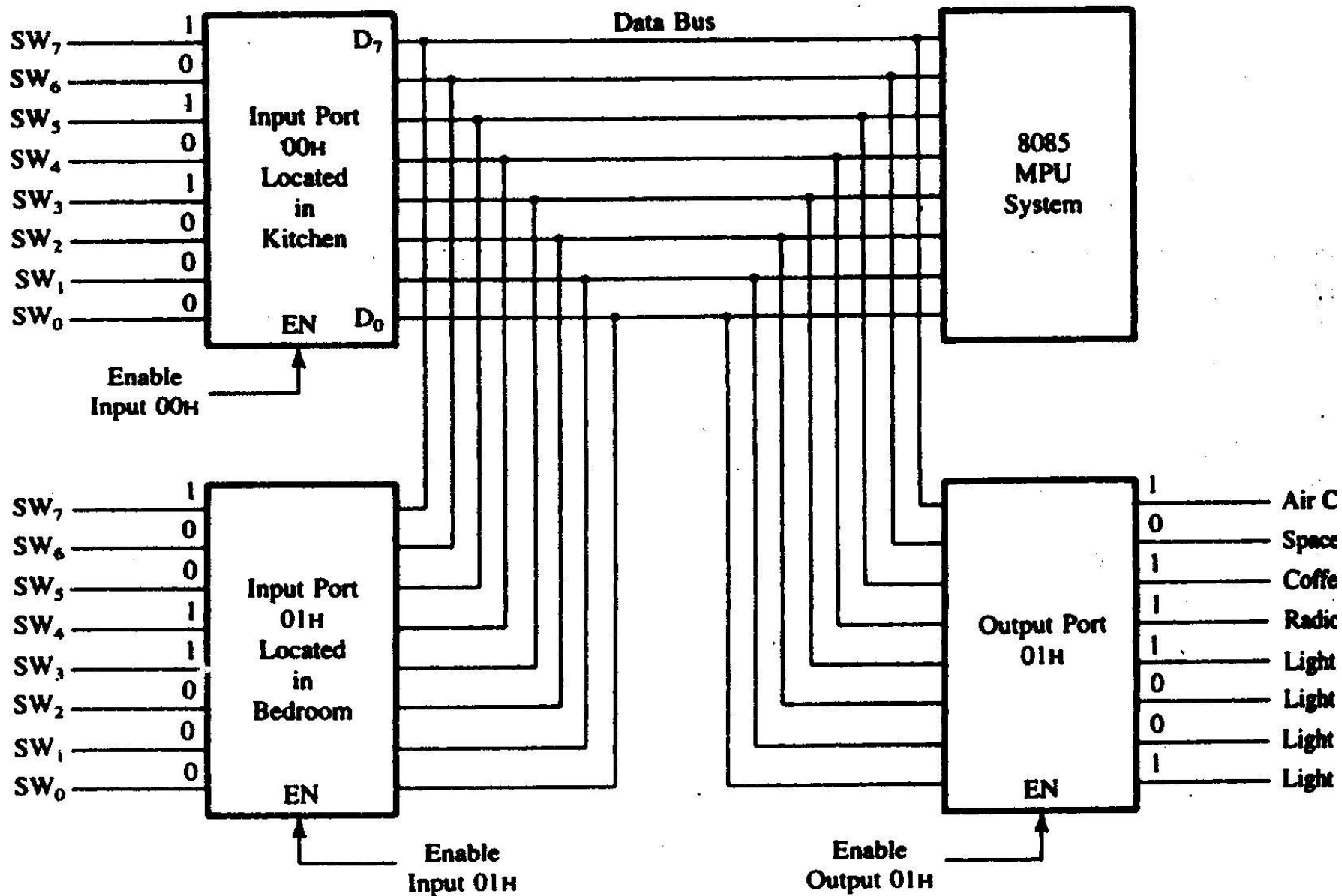
PROBLEM STATEMENT

An additional input port with eight switches and the address 01H (Figure 6.9) is connected to the microcomputer shown in Figure 6.8 to control the same appliances and lights from the bedroom as well as from the kitchen. Write instructions turn on the devices from any of the input ports.

PROBLEM ANALYSIS

To turn on the appliances from any of the input ports, the microprocessor needs to read the switches at both ports and logically OR the switch positions.

PROGRM

```
IN    00H
MOV   B,A
IN    01H
ORA   B
OUT   01H
HLT
```

FIGURE 6.9
Two Input Ports to Control Output Devices

6.52 Illustrative Program: <u>Microprocessor-Controlled Manufacturing Process</u>

PROBLEM STATEMENT

A microcomputer is designed to monitor various processes (conveyer belts) on the floor of a manufacturing plant, presented schematically in Figure 6.12.

Write a program to

1. Turn on the five conveyer belts according to the ON/OFF positions of switches $S_4 – S_0$ at port F1H.
2. Turn off the conveyer belts and turn on the emergency alarm only when both switches – S_7 from port F1H an S_7' from port F2H – are triggered.
3. Monitor the switches continuously.
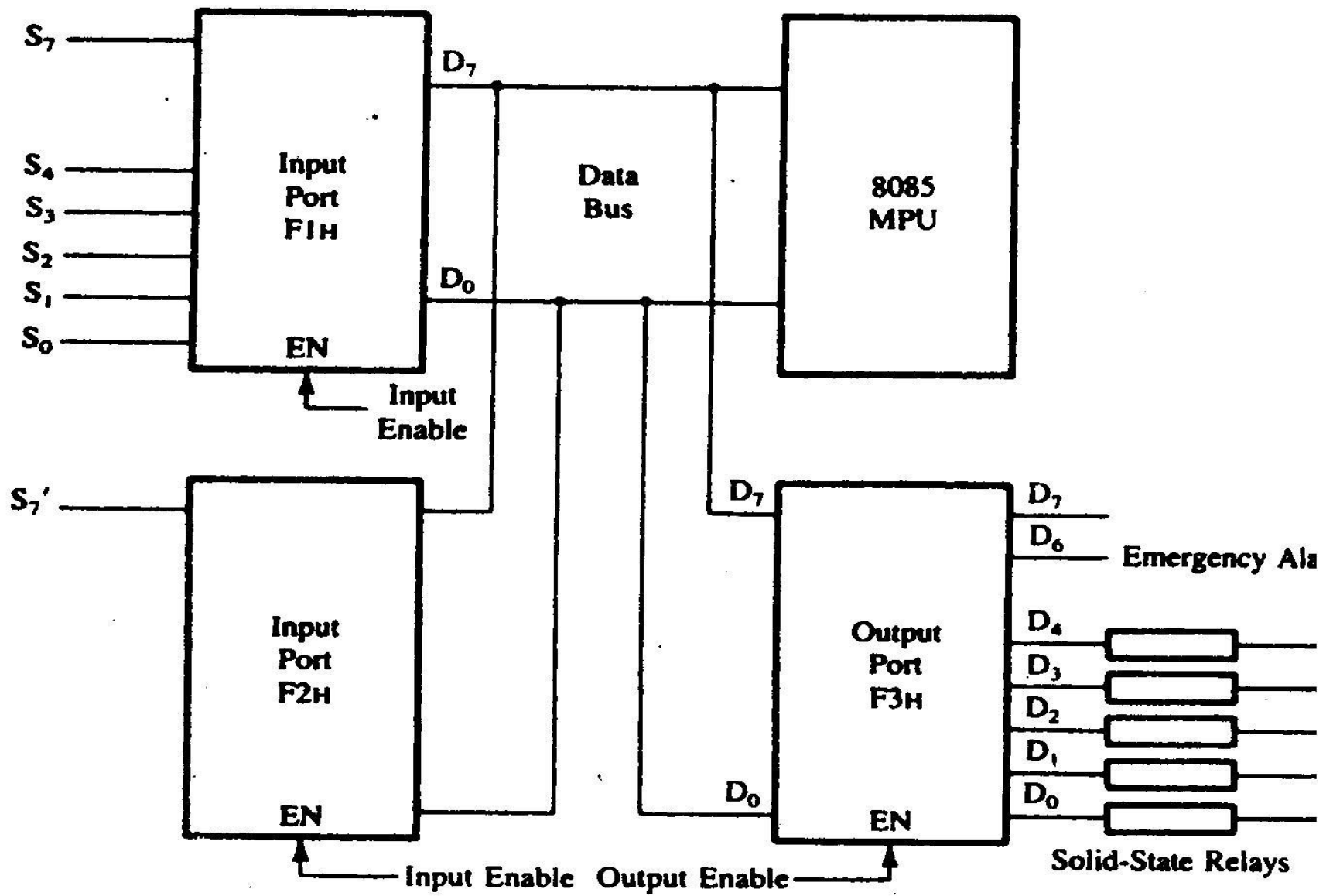
FIGURE 6.12
Input/Output Ports to Control Manufacturing Processes

PROBLEM ANALYSIS

To perform the tasks specified in the problem, the microprocessor needs to

1. read the switch positions.
2. check whether switches S_7 and S_7' from the ports F1H and F2H are on.
3. turn on the emergency signal if both switches are on, and turn off all the conveyer belts.
4. turn on the conveyer belts according to the switch positions S_0 through S_7 at input port F1H if both switches S_7 and S_7' are not on simultaneously.
5. continue checking the switch positions.

FLOWCHART AND PROGRAM

The five steps listed above can be translated into flowchart and an assembly language program as shown in Figure 6.13.

	Mnemonics	Comments
START:	IN F1H	;Read switches from port F1
	MOV B,A	;Save data from port F1
	IN F2H	;Read switches from port F2
	ANI 80H	;Mask all switch positions of F2 except S_7'
	MOV C,A	;Save S_7'
	MOV A,B	;Get data from F1 again
	ANI 80H	;Mask all switch positions of F1 except S_7
	ANA C	;Logically AND S_7 and S_7'
	JNZ SHTDWN	;If both S_7 and S_7' are on, transfer to shutdown
	MOV A,B	;If not, turn on conveyer belts
	ANI 1FH	;Mask bits D_5, D_6, D_7
	OUT F3H	
	JMP START	;Go back and check switches again
SHTDWN:	MVI A,40H	;Turn off conveyer belts and turn on emergency alarm
	OUT F3H	
	HLT	

Flowchart blocks:

Start → Read Input Ports and Save Data From Switches → Check S_7 and S_7' → Are S_7 and S_7' on?

- Yes → Turn on Emergency Alarm → End
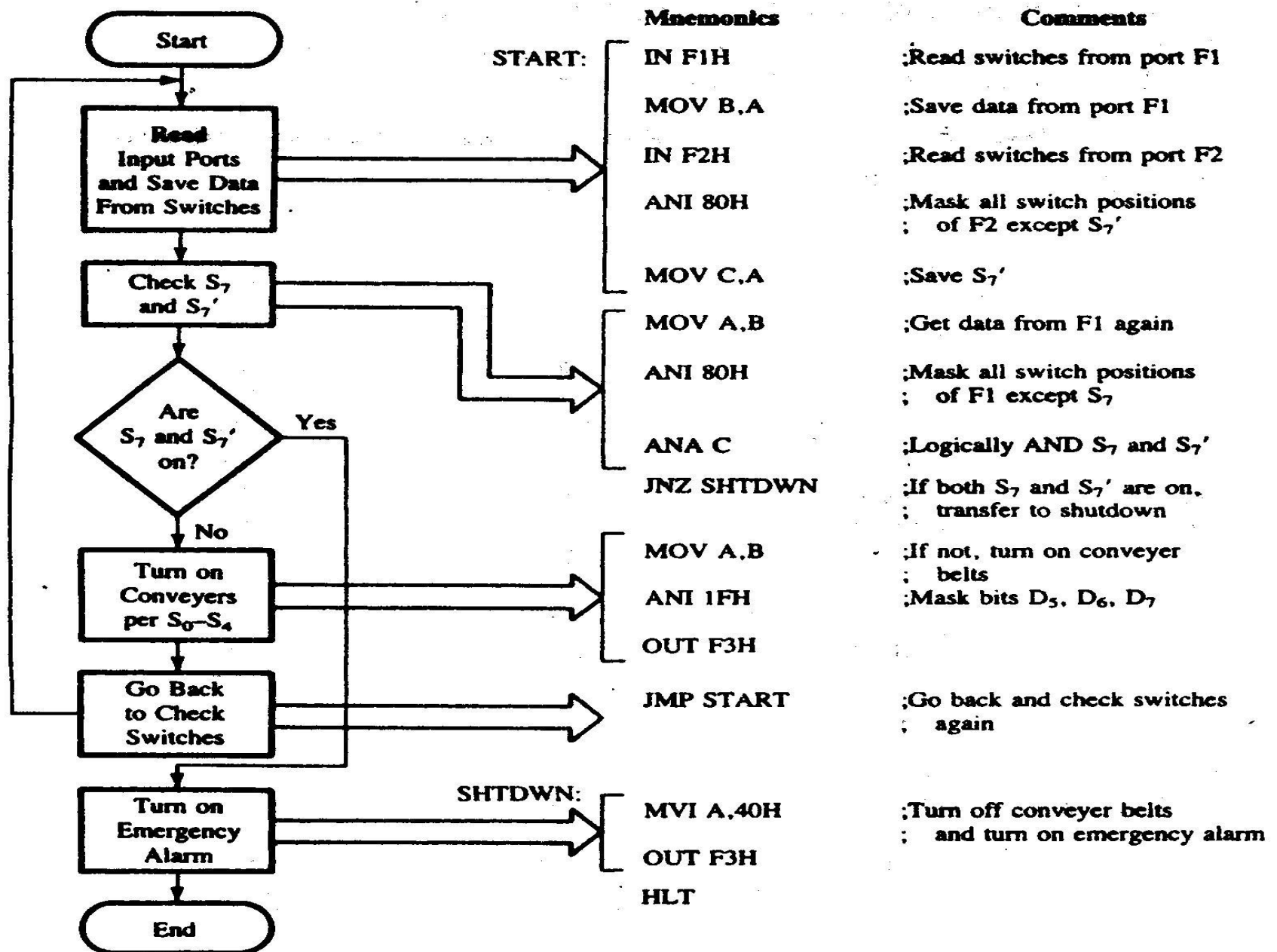- No → Turn on Conveyers per S_0–S_4 → Go Back to Check Switches → (loop back)

FIGURE 6.13
Flowchart and Program for Controlling Manufacturing Processes