



Third Year – Semester 1

SHEET 8 Basic Input Output and Interrupts

1) Review Questions:

- a) What is the difference between Memory mapped I/O and Isolated I/O?
- b) What are the operation modes of the 82C55? What is meant by Handshaking?
- c) How many counters exist in 8254? What is the maximum input frequency for each counter? What are the main functions of the 8254?
- d) State whether the following sentences are right or wrong and correct the wrong one if possible:
 - i) The instructions IN and OUT are used in the Isolated I/O method and cannot be used in the Memory Mapped I/O method.
 - ii) The 8255 requires a Wait state if the processor is clocked at higher than 10 MHz while the maximum clock input to any counter in the 8254 is 8MHz.
 - iii) The 16550 UART can send up to 1.5 Mbps after being synchronized with the receiver.
 - iv) NMI is an edge triggered interrupt that is decoded internally in the microprocessor and leads to the execution of INT2. It is used for Parity errors and system failure conditions.
 - v) The 8259A is a PIC that can handle up to 8 interrupt requests and up to 256 interrupt requests if connected in Master and Slave configurations.
 - vi) The memory hierarchy is a mechanism of comparing the cost and performance of the different memories used to store data and instructions.

- 2) Write the necessary assembly instructions to load the appropriate control word (shown below) to program the PPI 8255 for the I/O configuration shown in Figure 1 then read the input byte from Port A and add it to the byte read from Port B then output the result to Port C. Please reset all do not care bits in the address to zeros if exist.

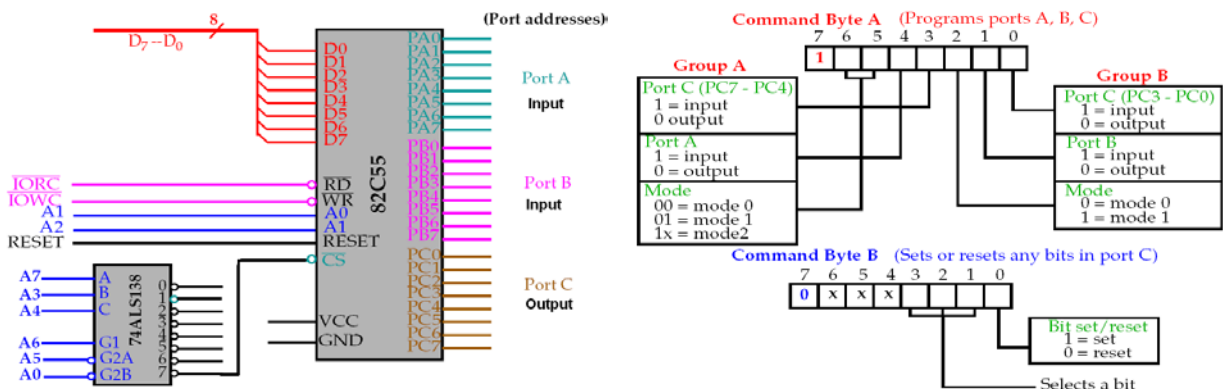


Figure 1

- 3) a) Modify the circuit shown in Figure 1 so that the 8255 functions at I/O ports 20-23H (Show modifications only).
- b) Program the 8255 in mode 0 so that Port A is an output port, Port B is an input port and Port C is an output port.

- c) Program again the 8255 PPI so that Port A is an input port with handshake and Port B is a simple input port.
- d) Draw a decoding circuit to connect the 8086 microprocessor to two 8255 chips to input or output 16-bit data. Write the port addresses that you have chosen for each chip.

- 4) For the circuit shown in Figure 3, which is used to connect a keyboard to a printer through an 8255 PPI, find the following:
- a) The port addresses of Port A , Port B , Port C and control word
 - b) The control word required to program the 8255. You may use Figure 3.
 - c) Write a program that sends data received from the keyboard to the printer.

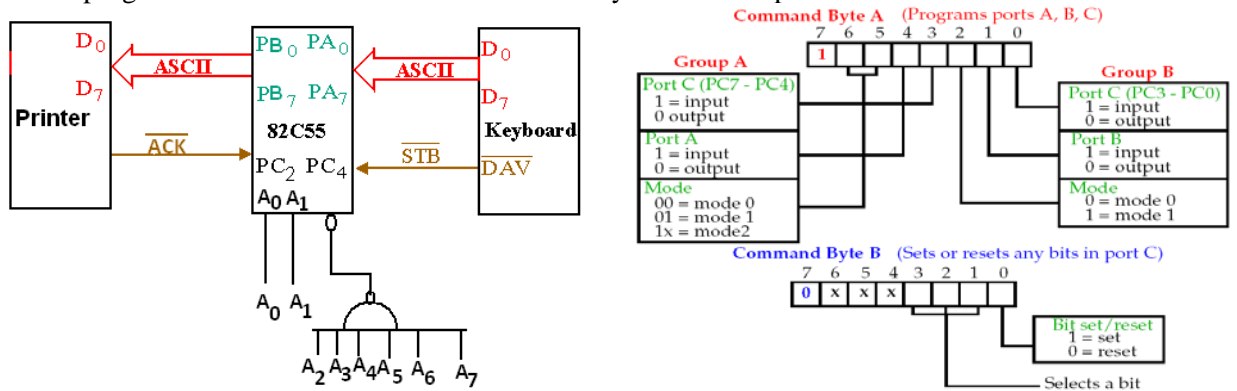


Figure 2

- 5) a) Write the PAL program to interface the 8254 chip shown in Figure 3 to an 80386SX microprocessor at I/O ports 0700H, 0702H, 0704H, and 0706H.
- b) Write an assembly program to generate a 100KHz square-wave at counter OUT0 and a 200KHz continuous pulse at counter OUT1.

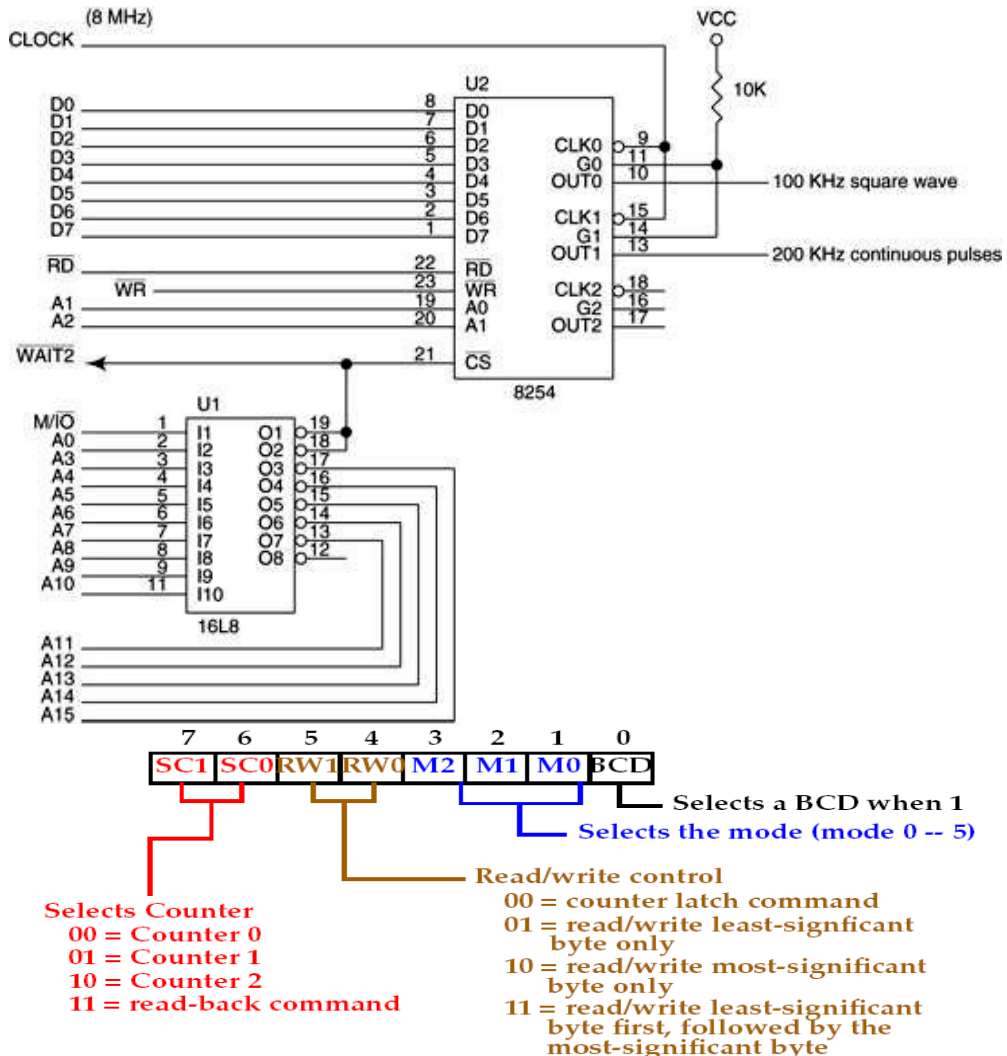
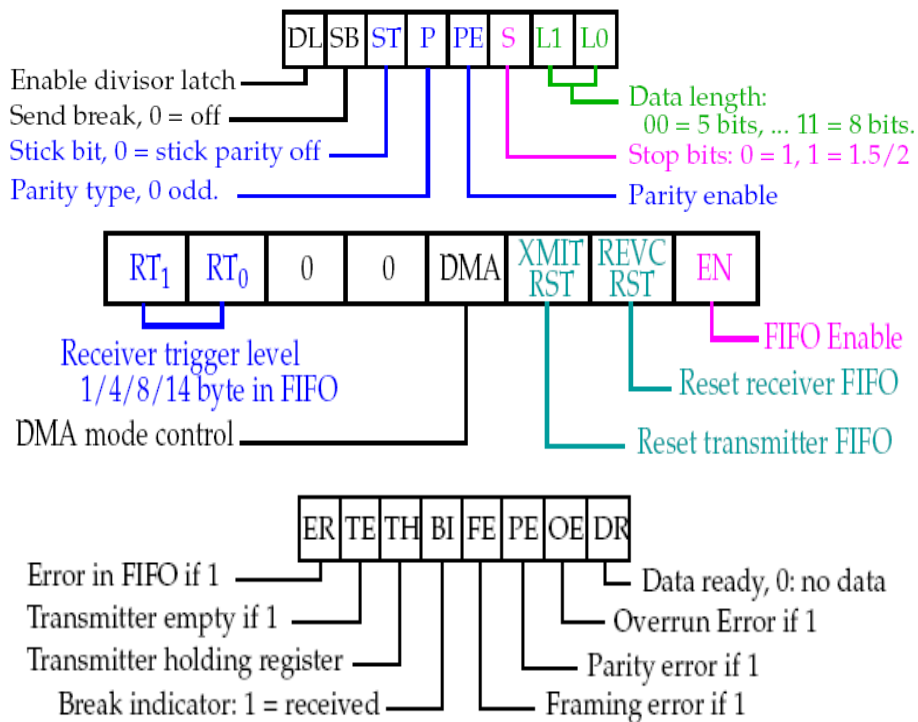


Figure 3

- 6) Assume two 16550 UARTs are interfaced to an 8088 microprocessor system. The first one is decoded at addresses 40-47H while the second one is decoded at addresses 50-57H. The first UART to receive data at a baud rate of 9600bps, even parity, 8 data bits and one stop bit. The received data is stored in AH then sent to the second 16550 at a baud rate of 1200 bps, odd parity, 8 data bits and one stop bit. Both UARTs are operated with a crystal of 18.432 MHz. Write an assembly program to initialize both UARTs and transmit data from the first UART and receive data at the second UART. Here is the necessary information to write your program. The table below is the addresses of the registers, followed by the line control register, followed by FIFO control register and finally the line status register.

A ₂	A ₁	A ₀	Register
0	0	0	Receiver buffer (read) and transmitter holding (write)
0	0	1	Interrupt enable
0	1	0	Interrupt identification (read) and FIFO control (write)
0	1	1	Line control
1	0	0	Modem control
1	0	1	Line status
1	1	0	Modem status
1	1	1	Scratch



- 7) a) List the events that occur for any interrupt instruction.
 b) Sketch a circuit that can allow the 8088 microprocessor to accept 8 different interrupt at a time using 74244. Indicate the addresses of the vectors of the IRQs.
 c) Figure 4 shows a method to expand the interrupt structure. What is the name of this method? Explain briefly the idea of the operation.

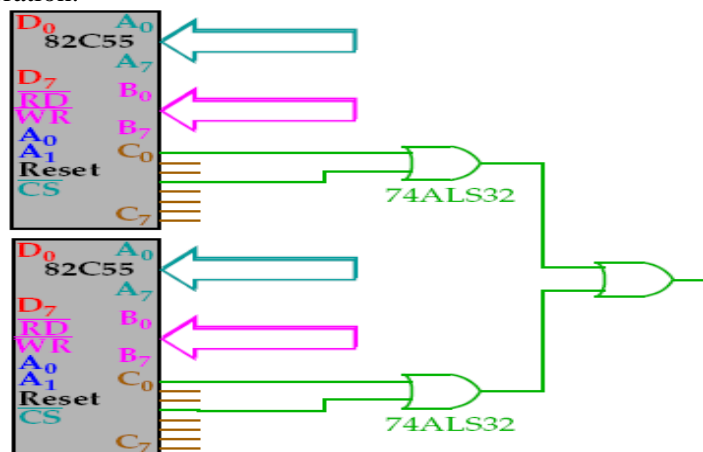


Figure 4

8) The circuit shown in Figure 5 contains 3 chips which are PAL 16L8, 16550 and 8259A. What is the function of each one? Program the 16550 for asynchronous operation using 6 data bits, even parity, 1 stop bit at a baud rate of 19,200 bps using a 18.432MHz clock. Assume that the 16550 is decoded at 40H-47H and the line control register is given below. Write the software procedure to initialize the 16550 and the 8259A and enable the INTR pin on the 8088 so that interrupts can take effect. Also write the interrupt handler procedure for the 16550 UART.

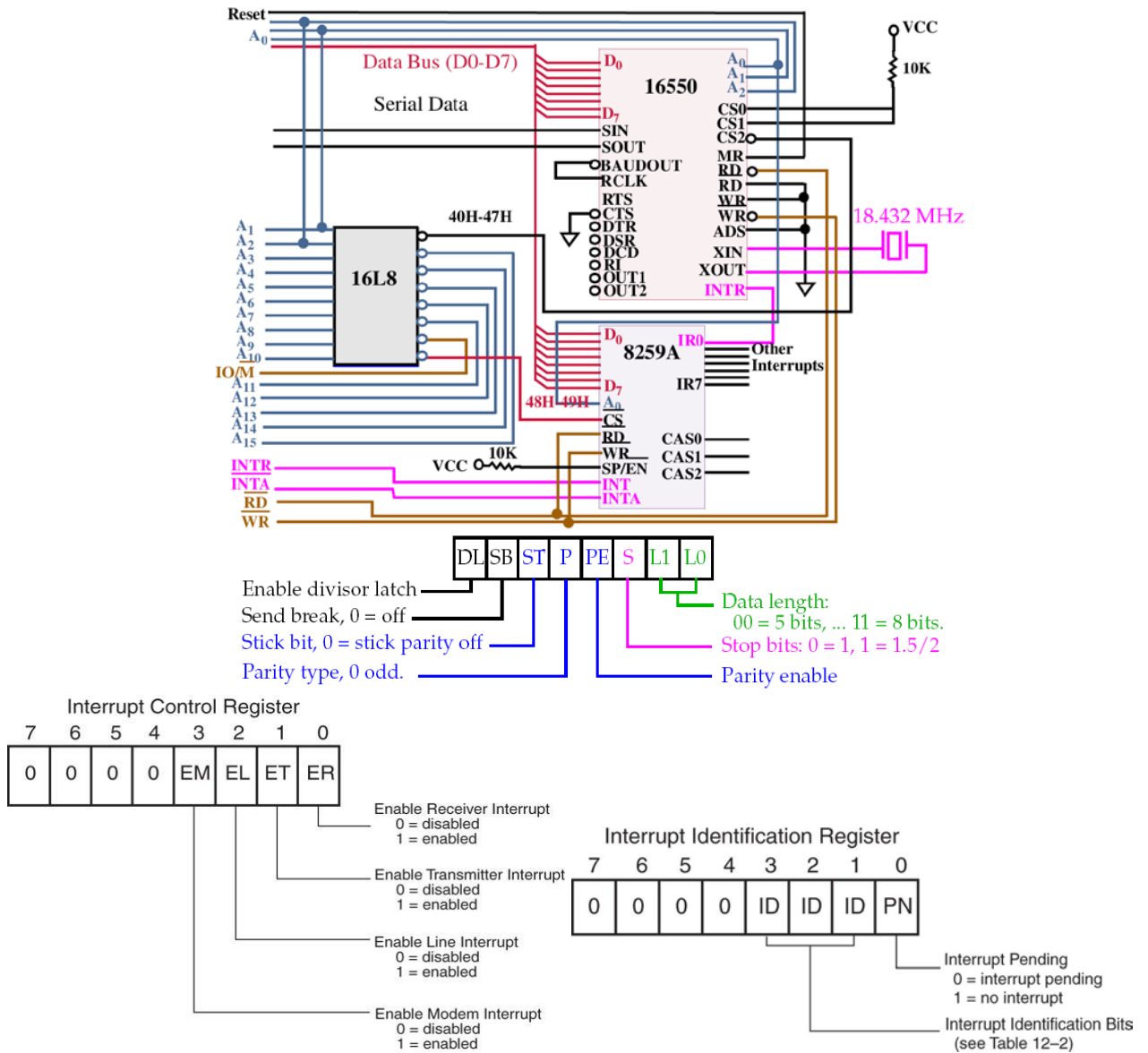


Figure 5