

- Q-1** the MUL AB instruction multiplies the unsigned (8 bit) contents of A and B and places the 16 bit result in B (MSB) and A (LSB). Write an assembly program to multiply two 8 bit signed numbers placed in A and B.

Hint: This can be done in two ways:

We can determine the sign of the product separately as the XOR of the most significant bits of A and B, compute the magnitude of the product and then adjust for sign – taking 2's complement if the product sign is negative.

Otherwise, A signed 8 bit number with bits  $b_{7-0}$  may be interpreted as (unsigned)  $b_{6-0} - 2^7b_7$ . The expression for the product may be expanded using this and computed accordingly.

- Q-2** Specify all the steps that need to be taken to generate a baud rate of 9600 for asynchronous serial communication in an 8052 using the timer T2, with a crystal frequency of 24 MHz. The relevant special function registers are:

T2CON register at BYTE address C8H								
Bit No.	7	6	5	4	3	2	1	0
Bit Name	TF2	EXF2	RCLK	TCLK	EXEN2	TR2	C/T2	CP/RL2
T2MOD register at BYTE address C9H								
Bit No.	7	6	5	4	3	2	1	0
Bit Name	-	-	-	-	-	-	T2OE	DCEN
SCON register at BYTE address 98H								
Bit No.	7	6	5	4	3	2	1	0
Bit Addr	9F	9E	9D	9C	9B	9A	99	98
Bit Name	SM0	SM1	SM2	REN	TB8	RB8	TI	RI
IE register at BYTE address A8H								
Bit No.	7	6	5	4	3	2	1	0
Bit Name	EA	-	ET2	ES	ET1	EX1	ET0	EX0

- Q-3** Two 8051 processors using 11.059 MHz crystals are to communicate with each other at 19200 baud, using 16X clock for synchronization. The accuracy of the crystal oscillator frequency is specified to be within  $\pm 0.1\%$  of the stated crystal frequency. What is the worst case phase error for sampling an incoming bit and when will this worst case error occur?
- Q-4** In an SPI interface, we may have up to 8 slaves, but we cannot afford to allocate 8 port pins as slave select outputs. Show how we can manage using just 3 port pins.
- Q-5** Show the timing for a data frame in the SPI interface for MODE 3.
- Q-6** Describe how a slave may slow down the data rate from a master (acting as a talker) by using clock stretching.

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Paper Ends

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