CPE 301 - MICROPROCESSOR SYSTEM DESIGN

HOMEWORK No. 9 - DUE (beginning of class) October 29

NOTE: All programs must be handed in as printouts of Arduino Sketch files which have compiled without errors.

NOTE: Do NOT use any C string library functions.

1. Assume the 8250 UART (the same UART as used in PCs) is connected to an ATmega2560 single board computer mapped as external data memory with a start address of FCC0 Hex. Write the following Arduino C language functions. See data sheet below for 8250 special function register details.

   For those who are interested, the data memory map for the 2560 is shown in the Atmega2560 data manual - Figure 9-1. External Memory with Sector Select.

   ASSUME THE 8250 UART IS ALREADY INITIALIZED (so you do not need to write UARTinit()).

a. kbhit(void): – will examine the RDA status bit and return a true (non-zero value) if RDA is true, otherwise it will return a false (0 value).
b. getchar(void): – will read one character from the serial port and return it.c.
c. putchar(char vname): – will write the character vname to the serial port as soon as TBE is true.

2. Write an Arduino C language function printstr(*unsigned char str0) which will print out a NULL terminated ASCII string using the serial I/O functions defined in Question 1 above. The input pointer str0 points to the first element of the string to be printed.

3. Write an ARDUINO C function called strlen() that determines the length of a null-terminated ASCII string. Pass a 16-bit address pointer to the first element of the string to the function. Return the length, excluding the null byte.

4. Write an ARDUINO C function to create a fixed length destination string by copying a source string and truncating or padding with spaces as needed. Pass three variables to the function: 1) the length of the output string, 2) a 16-bit address pointer to the first element of the source string, and 3) a 16-bit address pointer to the first element of the destination string. The function does not return any value.

5. Write an ARDUINO C function to compare two character strings and determine whether one is less than, greater than, or equal to the other. Assume the strings are null-terminated. Pass a 16-bit address pointer to the first element of the first string, and a 16-bit address pointer to the first element of the second string. Return -1 if the first is less than the second, return 0 if the strings are equivalent, and return + 1 if the first is greater than the second.

Table 3-2: Register summary for 8250, 16450, and 16550 UARTs.

Address	Access	Name	Abbrev.	Bit Number							
				7	6	5	4	3	2	1	0
0	DLAB= 0, read only	receive buffer	RBR	received data							
	DLAB= 0, write only	transmit holding register	THR	transmit data							
	DLAB= 1, read/ write	divisor latch, low byte	DLL	baud rate divisor low byte							
1	DLAB= 0, read/ write	interrupt enable	IER	0	0	0	0	modem status	receiver line status	transmit holding register empty	received data available
	DLAB= 1, read/ write	divisor latch, high byte	DLM	baud rate divisor high byte							
2	read only	interrupt identify	IIR	FIFOs enabled**: 11 if FCR bit 7=1, 00 if FCR bit 7=0		0	0	Interrupt ID: 011=receive line status 010=received data avail. 110=character timeout 001=TR hold. reg empty 000=modem status			-Interrupt Pending
	write only**	FIFO control**	FCR **	receive FIFO trigger level:** 00=1 byte 01=4 bytes 10=8 bytes 11=14 bytes		reserved **	reserved **	DMA mode select**	transmit FIFO reset**	receive FIFO reset**	FIFO enable**
3	read/ write	line control	LCR	divisor latch access bit (DLAB)	break set	stick parity set	even parity set	parity enable	stop bits: 0=1 bit 1= 2 bits	word length: 00=5 bits 01=6 bits 10=7 bits 11=8 bits	
4	read/ write	modem control	MCR	0	0	0	loop-back mode	-OUT2 (-IRQ enable on PCs)	-Out1	request to send (RTS)	data terminal ready (DTR)
5	read only	line status	LSR	error in receive FIFO	transmit buffer empty	transmit holding reg.	break interrupt	framing error	parity error	overrun error	data ready
6	read only	modem status	MSR	data carrier detect (CD)	ring indicator (RI)	data set ready (DSR)	clear to send (CTS)	change in CD	RS-232 falling edge at RI	change in DSR	change in CTS
7	read/ write	scratch*	SCR	scratch register, no designated function							
*16450 and 16550 only, **16550 only											