In the following questions assume the 8051 serial port is initialized in 8-bit UART mode and the baud rate is provided by Timer 1.

(1) [2 marks] Write a subroutine GETCHAR which will read one character from the serial port into A or wait until a character is available.

GETCHAR:
JNB RI, $ ; wait for a serial port receive interrupt flag
CLR RI ; clear the interrupt flag
MOV A, SBUF ; copy the character from the buffer
RET

(2) [2 marks] Write a subroutine PUTCHAR which will write a character in A to the serial port.

PUTCHAR:
JNB TI, $ ; wait for a serial port transmit interrupt flag
CLR TI ; clear the interrupt flag
MOV SBUF, A ; copy the character to the buffer
RET

(3) [6 marks] Using the GETCHAR function in Question 1, write a function GETSTRING that gets a string of characters terminated by a carriage return (ASCII 0Dh) as input from the serial port, and places them into XDATA starting at a location given in DPTR as a null-terminated string. (Note: you need not have completed Question 1 in order to answer this question).

CR EQU 0Dh
NULL EQU 00h

GETSTRING:
CALL GETCHAR ; get the next character
CJNE A, #CR, XSTORE ; if it's not equal to CR, store it
MOV A, #NULL ; otherwise replace CR by NULL
MOVSX @DPTR, A ; and write string null terminator
SJMP $ ; finish

XSTORE:
MOVSX @DPTR, A ; store the given character to XDATA
INC DPTR ; increment pointer
AJMP GETSTRING ; move on to next character