ME477, Lab 3

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Description:

This program tests the lowest-level functions `getkey()` and `putchar_lcd()`, which communicate with the keypad and LCD screen respectively. Communication with the keypad is achieved with the subfunctions Dio_ReadBit and Dio_WriteBit, which control the voltage of the keypad columns. A key is identified by setting the voltage of a column low and cross-checking each row; if there is a match, the key at the row-column intersection must be pressed. Communication with the LCD is achieved with a Universal Asynchronous Receiver/Transmitter (UART), which writes arguments in the range 0-127. These arguments include characters, numbers, symbols, and escape sequences.

This program also calls the functions `printf_lcd()`, which prints strings to the LCD screen, and `printf_lcd()`, which gathers input strings from the keypad. The main function calls `getkey()` and `putchar_lcd()` directly, as well as through `printf_lcd()` and `fgets_keypad()`. The overall hierarchical structure of the program is shown below.

```
main
|_ fgets_keypad()          - user keypad entry
|     |_ putchar_lcd()     - one char. to LCD output(function to test)
|          |_ Uart_Open    - initializes communication
|          |_ Uart_Write   - sends to display
|     |_ getkey()          - get 1 char from keypad(function to test)
|          |_ Dio_ReadBit  - reads a row or column, sets High-Z
|          |_ Dio_WriteBit - writes a row or column, sets Low-Z
|          |_ Wait         - waits for xxx ms
|_ printf_lcd()            - print string to LCD display
      |_ putchar_lcd()     - one char. to LCD output(function to test)
```

Testing:

1. Run the program
2. The LCD screen will display a text input from `putchar_lcd()`
    a. It will not display `putchar_lcd(400)`, as that is out of the accepted range
3. The LCD screen will also display the prompt "`Enter value:` "
    a. Hit any one key on the keypad
    b. The console will print "`getkey value:` " and the key you entered
4. The LCD screen will clear and display the second prompt "`Enter values:` "
    a. Type a string of values in the keypad and hit "Enter"
    b. The console will print "`fgets_keypad string:` " and the key you entered
5. The LCD screen will display a string from `printf_lcd()`

Results:

The functions `getkey()` and `putchar_lcd()` successfully communicate with the keypad and the LCD screen. They return one key at a time, and can be called through higher-level functions to return strings. The `getkey()` function would be more intuitive for the user with the current setup if it also called either `putchar_lcd()` or `printf_lcd()`, since this immediately would show the value being typed.