Singapore Polytechnic
School of Electrical and Electronics Engineering
ET0104 Embedded Computer Systems DECC 3FT/4EO

Tutorial 5 LCD

1. There are 3 connections to power supply: Vdd, Vss, and V_O. The V_O voltage controls LCD's constrast. It can be adjusted by a variable resistor or digitally by DAC. (NOT software)

   DDRAM: Display Data RAM: stores the intended display data and corresponds to the display position on the LCD.
   CGRAM: Character Generator RAM, for storage of user-defined characters or symbols.
   CGROM: Character Generator ROM, stores all standard characters and symbols, either 5x7 or 5x10 dots.

   E: used to clock data and control signals into LCD (pg 5-15)
   RS: register selection, 1 for data register and 0 for instruction register, reading Busy flag and address counter. (pg 5-5)
   R/$\overline{W}$: read or write control, 1 for read, 0 for write (pg 5-5)
   Data bus: either 4 bits (DB4-DB7) or 8 bits (DB0-DB7). (pg 5-3,5-16)

2.

Direct DDRAM addressing	Host buffer construction
Fast - write only characters needed	Can debug display at host Use C compiler to format data Use interrupts to send buffer
Hard to troubleshoot Need to keep track and erase previous chars	May send redundant chars

3. -Check the Busy Flag, - read from LCD, the Busy Flag is DB7, if it's low, it is not busy, then can write another instruction.
   -Another method is after writing an instruction to LCD, delay a sufficient time before sending another instruction.

4. 8 bit

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	ACTIONS
0	0	0	0	1	1	0	0	X	X	Function set, 5x7 dots
0	0	0	0	0	0	0	0	0	1	Clear display
0	0	0	0	0	0	0	1	1	0	Entry mode set
0	0	0	0	0	0	1	1	1	X	Display, cursor on/off
0	0	0	0	0	1	0	1	X	X	Cursor shifting
0	0	0	0	0	0	0	0	1	X	Return home
0	0	1	0	0	0	0	0	0	0	Set DDRAM addr. 00
1	0	0	1	0	1	0	0	0	0	Write “P”
1	0	0	1	1	0	1	1	1	1	Write “o”
1	0	0	1	1	0	1	1	0	0	Write “l”
1	0	0	1	1	1	1	0	0	1	Write “y”

5. 4 bit

RS	R/W	DB7	DB6	DB5	DB4	Actions
0	0	0	0	1	0	Function set, 4 bit mode, 1 line, 5x7 dot
0	0	0	0	X	X	
0	0	0	0	0	0	Display on, cursor on
0	0	1	1	1	X	
0	0	0	0	0	1	Cursor shifting right after each character
0	0	0	1	X	X	
0	0	0	0	0	0	Entry mode, increment
0	0	0	1	1	0	
1	0	0	1	0	1	Write “P”
1	0	0	0	0	0	
1	0	0	1	1	0	Write “o”
1	0	1	1	1	1	
1	0	0	1	1	0	Write “l”
1	0	1	1	0	0	