Memorial University of Newfoundland

Engineering 4862 MICROPROCESSORS

Assignment 3

Instructor: Cheng Li

Due: June 10, 2005

Unless otherwise noted, please show all relevant calculations, and explain your answers where appropriate.

- **0.** For each of the CF, PF, ZF, SF, and OF flags, briefly describe the meaning when it is set. Give conditional jump instructions that can be used to test each one.
- **1. a.** Determine the contents of register BX and the six conditional (status) flags after each of the following instructions executes. If a flag or register contents are unknown, indicate with a '?'.
 - CLC MOV BL, 4DH SUB BL, 3EH XOR BH, BH MOV [SI], BX

b. Read how to use debug in appendix A of the textbook. For each instruction in (a), use DEBUG (or some other program) to determine the equivalent machine code.

- 2. Assume that the PUSH instruction does not exist in the 8086/8088 instruction set. Write a sequence of instructions that function equivalently to PUSH DX. You may use any other valid instruction, but restore any registers you change that PUSH DX does not.
- **3.** Write a subroutine to replace the multiplication instruction MUL CX. You may use any valid 8086/8088 instructions other than MUL, but take care to properly handle the flags and restore any registers that you use to store temporary values. Start your subroutine with the label mul_cx, and end with the RET instruction.
- **4.** Write a MUN-88-compatible program that reads the contents of the DIP switches, and then converts the 8-bit decimal value into two 8-bit ASCII values representing each hex digit. Store the lower digit in AL, and the upper digit in AH. This should be a full program, so include a title, segment definitions, etc., as well as comments.

Example result: Suppose that after reading the input port for the DIP switches, AL is 9FH. Your program should place 39H (ASCII for '9') into AH, and 46H (ASCII for 'F') into AL.

5. Write a program that subtracts two multi-digit ASCII numbers (Data1 – Data2). The result should be saved back to Result in ASCII. The Data Segment is defined as following:

DTSEG		SEGMENT
Data1	DB	`3546882164 <i>'</i>
Data2	DB	`2345611245 <i>'</i>
Result	DB	10 DUP (?)
DTSEG		ENDS

6. Write a program that converts an ASCII string saved by Old_String to its uppercase in ASCII and save back to the New_String. Leave the space and period unchanged. The Data Segment is defined as following:

DTSEG		SEGMENT
Old_String	DB	'This is THE String to be converted.'
New_String	DB	35 DUP (?)
DTSEG		ENDS