CmpE213 – Digital Systems Design

Homework 5

Machine instructions for the 8051

1. Write an instruction (or set of instructions):
   (a) Exchange the value of the accumulator with the value in R4.
   (b) Set the current register bank to bank 3 (be careful – is the PSW bit-addressable?).
   (c) Jump backward 42H bytes if the carry flag is set.
   (d) clear the accumulator using only a 1-byte instruction.
   (e) increment the value of the DPTR by 1.
   (f) Jump forward 42H bytes if the accumulator is not equal to 2AH.
   (g) perform a bit-wise logical XOR between the bits in the accumulator and the bits at internal memory location 42H.
   (h) push the value #42H onto the stack.
   (i) Decrement the value of R0 and jump forward 42 bytes if the result is not zero.
2. Different addressing modes can be used to accomplish the same result. For each addressing mode (direct, indirect, immediate, register), write an instruction which loads the accumulator with the value #42H. For each instruction, list precisely which addressing modes are used. For instance, MOV 2AH, #42 uses direct and immediate.
3. Assume you are to write a jump instruction which will be at address 5280H in code space. Show a jump instruction for each addressing mode (relative, absolute, long) which jumps to code memory location 522AH. Give the opcode for each instruction.
4. For the following code,

```
start: MOV 2AH, #5
       MOV R0, #80H
       CLR A
loop:  MOV @R0, A
       INC R0
       DJNZ 2AH, loop
stop:  JMP stop
```

   a) Find the final value of any registers or memory changed by executing this code segment.

   b) Find the number of bytes in code memory this instruction sequence occupies.

   c) Find the number of instruction cycles, machine cycles, clock cycles and total amount of time this code takes to complete (Assume it's complete when it hits JMP stop). Assume the clock is running at 12MHz.

d) Explain why this code does not change the value of special function registers P0, SP, DPL, etc., located at internal memory locations 80H, 81H, etc.

e) Write the machine code and corresponding code memory locations for the above code segment (use a table). Assume that code memory starts at 0000H.

5. Problem 30 in Chapter 3, MacKenzie. Assume a 12 MHz clock.