1. What is the difference between a relative address and an absolute address. Why would you use one over the other?

2. The I/O ports on the 8051 are initialized to input on reset. Why?

3. The 8051 allows memory to memory move operations. Give an example of how this can be done.

4. Are the following instructions correct? If so, mark them correct. If not, explain what is wrong.
   A) mov a, #302
   B) mov a, @r3

5. How many times is the \texttt{mov P1.0, c} instruction executed in each of the following?
   A) \begin{verbatim}
   mov a, #55h
   mov R5, #42
   LP: mov R6, #24
   LP1: rlc a
   mov P1.0, c
   djnz R6, LP1
   djnz R5, LP
   \end{verbatim}
   B) \begin{verbatim}
   mov R1, #0
   mov R2, #12
   mov a, #0AAh
   LP: inc R1
   rrc a
   inc R1
   mov P1.0, c
   cjne R1, R2, LP
   \end{verbatim}
   C) \begin{verbatim}
   mov R1, #23
   mov R2, #0FFh
   LP: mov a, R2
   rrc a
   mov P1.0, c
   dec R2
   dec R1
   mov a, R1
   jnz LP
   \end{verbatim}

6. The assembly instruction \texttt{mov a, 123} moves data from memory location 123 to the accumulator. Show how to do this same thing using register indirect addressing.
7. What is in the accumulator after each of the following?

A) mov R6, #2  
   mov R5, #22h  
   mov A, 5  
   orl A, 6  
   A = _____________

B) mov A, #0AFh  
   mov R1, #55h  
   anl A, R1  
   orl 1, A  
   mov A, 1  
   A = _______________

C) mov A, #0A5h  
   add A, ACC  
   rr A  
   add A, ACC  
   rr A  
   A = _______________

8. Show what is in registers R0 to R3, the accumulator, and internal memory locations 15 to 20 when the program below completes. Assume register bank 0. Use an x for unknown.

```
Main SEGMENT CODE
CSEG at 0h
ljmp Start
RSEG Main
Start: mov sp, #16
   mov a, #0aah
   mov r0, #0
   mov r1, #1
   mov r2, #2
   mov r3, #3
   push acc
   pop 3
   push 1
   push 2
   push 3
   pop 0
   pop acc
   pop 3
Last:sjmp Last
END
```

<table>
<thead>
<tr>
<th>R0</th>
<th>R1</th>
<th>R2</th>
<th>R3</th>
<th>Acc</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
<th>19</th>
<th>20</th>
</tr>
</thead>
</table>

9. Answer the following questions about the MACRO below:

A) What is the name of the MACRO?
   M1 MACRO x, y

B) Give an example of how the MACRO can be used in a program.
   LOCAL LP
   mov r1, x
   mov a, y
   LP: rrc a
   mov P1.3, c
   djnz r1, LP

C) What is the purpose of the LOCAL declaration?

10. Write an assembly language program to input the least significant bit from port 1 and add this bit to the data in R2. If this add produces a carry send the 8-bit sum to P3. Otherwise, do nothing.