1. Consider the following 8-bit hexadecimal numbers as unsigned. Find their decimal equivalents:

   (a) 0xA2
   (b) 0x85
   (c) 0x6C
   (d) 0x1E

2. Repeat Problem 1, considering the numbers as signed.

   (a) 0xA2
   (b) 0x85
   (c) 0x6C
   (d) 0x1E

3. Do the operations indicated below. The operations are performed in an 8-bit accumulator. Find the 8-bit results for the operations. Indicate the state of the N, Z, C and V bits after each operation.

   (a) 0x4C + 0x53
   (b) 0x93 + 0x8A
   (c) 0x8E + 0x72
   (d) 0x4C - 0x53
   (e) 0x53 - 0x4C

4. Write an instruction sequence to subtract the 8-bit number stored in address $2010 from the 8-bit number stored in $2000, and store the 8-bit difference in $2005.

5. Write an instruction sequence which adds the contents of accumulator B to the 16-bit number stored at locations $2000 and $2001, and stores the 16-bit result in addresses $2002 and $2003. Treat the value stored in B as a signed number. (Hint: use the SEX instruction.)

6. Consider the program below:

   ```assembly
   prog:   equ       $1000
   CODE:   section   .text
           org       prog
   
           ldaa       #22
           movb       #53,$2002
   loop:   ldab       #127
           sba
           std       $2000
           beq       $loop
           swi
   ```
(a) Hand assemble the program. Determine the hex numbers which will be generated when this program is assembled, and at what locations they will be stored in the HC12. For example, the \texttt{ldaa} \texttt{#22} instruction will result in

<table>
<thead>
<tr>
<th>mnemonic</th>
<th>addr</th>
<th>code</th>
<th>Addressing Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>ldaa #22</td>
<td>$1000</td>
<td>$86</td>
<td>Immediate</td>
</tr>
<tr>
<td></td>
<td>$1001</td>
<td>$16</td>
<td></td>
</tr>
</tbody>
</table>

(b) Determine the values of the N, Z, C, and V bits after each instruction in the above program. (Assume that all the bits are 0 before the execution of the first instruction.)

7. How many instruction cycles will it take the HCS12 to execute the following program? (Do not consider the \texttt{swi} instruction.) How many microseconds will this take the HCS12 with an 24 MHz E-clock?

```assembly
prog: equ $1000
CODE: section .text
org prog
ldy #20
loop1: ldx #500
loop2: dex
        bne loop2
        dey
        bne loop1
        swi
```

8. An HCS12 has the following data in its memory:

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20D0</td>
<td>10</td>
<td>23</td>
<td>3B</td>
<td>7C</td>
<td>10</td>
<td>04</td>
<td>86</td>
<td>80</td>
<td>B7</td>
<td>10</td>
<td>25</td>
<td>3B</td>
<td>FC</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>20E0</td>
<td>20</td>
<td>F5</td>
<td>FD</td>
<td>10</td>
<td>18</td>
<td>86</td>
<td>40</td>
<td>B7</td>
<td>10</td>
<td>23</td>
<td>3B</td>
<td>FC</td>
<td>10</td>
<td>12</td>
<td>DD</td>
</tr>
<tr>
<td></td>
<td>20F0</td>
<td>86</td>
<td>02</td>
<td>B7</td>
<td>10</td>
<td>23</td>
<td>3B</td>
<td>7C</td>
<td>10</td>
<td>03</td>
<td>86</td>
<td>40</td>
<td>B7</td>
<td>10</td>
<td>25</td>
<td>3B</td>
</tr>
</tbody>
</table>

Determine the contents of the A register after executing the following code fragments. List the value in hexadecimal.

(a) \texttt{ldaa} \texttt{#37}
(b) \texttt{ldaa} \texttt{$20E7}
(c) \texttt{ldx} \texttt{$20E0}
   \texttt{ldaa} \texttt{-2,X}
(d) \texttt{ldx} \texttt{$20E0}
   \texttt{ldaa} \texttt{-2,X}
(e) \texttt{ldx} \texttt{$20E0}
   \texttt{ldaa} \texttt{2,+X}
(f) \texttt{ldx} \texttt{$20E0}
   \texttt{ldaa} \texttt{2,X+}