**Answer to Self-Assessment problem 8**

|  |  |  |
| --- | --- | --- |
| 19   + 7 | 19   – 7 | –19    + 7 |

First, compute the 2's complement of 19 and 7:

| sign-magnitude: | +710 = 0000 01112 | +1910 = 0001 00112 |
| --- | --- | --- |
| 1's complement: | –710 = 1111 10002 | –1910 = 1110 11002 |
|  | +1 | +1 |
| 2's complement: | –710 = 1111 10012 | –1910 = 1110 11012 |

Then perform the additions:

|  |  |  |
| --- | --- | --- |
| 19   = 0001 0011 | 19 =     0001 0011 | –19 =  1110 1101 |
| 7   = 0000 0111 | – 7 =     1111 1001 | + 7 = 0000 0111 |
| +26 = 0001 1010 | 12 =  1 0000 1100 | –12 = 1111 0100 |
|  | =     0000 1100 when the overflow bit (1) is dropped |  |



|  |  |  |
| --- | --- | --- |
| 35   + 27 | 35   – 27 | – 35   – 27 |

First, compute the 2's complement of 27 and 35:

|  |  |  |
| --- | --- | --- |
| sign-magnitude: | +2710 = 0001 10112 | +3510 = 0 010 00112 |
| 1’s complement: | –2710 = 1110 01002 | –3510 =  1101 11002 |
|  | +1 | +1 |
| 2’s complement: | –2710 = 1110 01012 | –3510 =  1101 11012 |

Then perform the additions:  
(Note that the 3rd addition is the sum of two negative numbers.)

|  |  |  |
| --- | --- | --- |
| 35 = 0010 0011 | 35 =     0010 0011 | – 35 =    1101 1101 |
| 27 = 0001 1011 | –27 =     1110 0101 | – 27 =    1110 0101 |
| +62 = 0011 1110 | 8 =  1 0000 1000 | – 62 = 1 1100 0010 |
|  | =     0000 1000 | =    1100 0010 |
|  | when the overflow bits are dropped | |



|  |  |  |
| --- | --- | --- |
| 96   + 15 | 96  – 15 | – 96   + 15 |

First, compute the 2's complement of 96 and 15:

|  |  |  |
| --- | --- | --- |
| sign-magnitude: | +9610 = 0110 00002 | +1510 = 0000 11112 |
| 1’s complement: | – 9610 = 1001 11112 | –1510 = 1111 00002 |
|  | +1 | +1 |
| 2’s complement: | –9610 = 1010 00002 | –1510 = 1111 00012 |

Then perform the additions:

|  |  |  |
| --- | --- | --- |
| 96 = 0110 0000 | 96 =     0110 0000 | –96 = 1010 0000 |
| +15 = 0000 1111 | –15 =     1111 0001 | +15 = 0000 1111 |
| 111 = 0110 1111 | 81 = 1 0101 0001 | –81 = 1010 1111 |
|  | =     0101 0001 when the overflow bit is dropped |  |