EXAMPLE 3

OBJECTIVE
This simple example has the following objectives:

- Review the principles of the decimal numbers, i.e., in the range 0 – 9
- Review the decimal carry concept, i.e., when a result is outside the 0 – 9 range.
- Prepare the ground for hex arithmetic

PROGRAM
Ex3.asm program is similar to ex2.asm, but uses numbers that give the result outside the 0 – 9 range. It performs the arithmetic operation 7 + 6 = 13. To achieve this, the program does the following:

- Load the number 7 into accA using LDAA, i.e., 7 \rightarrow A
- Load the number 6 into accB using LDAB, i.e., 6 \rightarrow B
- Add the number in accA (i.e., 7) with the number in accB (i.e., 6) A + B \rightarrow A \ A \ A \ 13

EXECUTION
Open THRSim11. Maximize THRSim11 window. Close the Commands window. Open file Ex3.asm. Assemble file. Tile windows. Set break point at the line containing SWI. Set the display of A, B registers to 'Decimal'. Reset registers D, X, Y. Your screen should look like this:
Use the ‘Step’ button to step through the program. Press the Step button once. The registers do not change. Press again. Number 7 is loaded into accA. Press again. Number 6 is loaded into accB. Press again. AccA and AccB are added together. The result, 13, appears in accA. The number 6 is still preserved in AccB. Your screen should look like this:

WHAT YOU HAVE LEARNED

In this simple exercise, you have prepared the ground for understanding hex arithmetic by reviewing decimal arithmetic with results outside the range 0 – 9. The things that you have reviewed are:

- In decimal arithmetic, the base of the number system is ten
- Ten independent symbols exist for representing the first ten numbers in the decimal system: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. These symbols are called digits.
- The greatest number that can be represented with a single decimal symbol is nine.
- Numbers greater than nine are represented with two or more digits. For example, number thirteen is represented as 13, i.e. with two digits.
- The symbol furthest to the left is called the most significant digit (MSD). In number 13, the most significant digit is 1. It signifies the number of tens contained in the number. In our case, we have only one ten, since 1 x ten = ten
- The symbol furthest to the right is called the least significant digit (LSD). In number 13, the least significant digit is 3. It signifies the number of units contained in the number. In our case, we have three units, since 3 x units = three.
- The complete number is assembled by adding the contribution of all digits, from LSD through MSD. In number 13 there are two digits, MSD = 1, LSD = 3. The complete number is 1 x ten + 3 x units = ten + three = thirteen.
- When the result of an addition is greater than nine, a carry occurs.
- New words and notations: digits, most significant digit (MSD), least significant digit (LSD), carry.