# Laboratory 5

# Format Conversion

**Concepts:**

* Different forms of number representations including hexadecimal (binary), binary coded decimal, and ASCII.

**Objectives:**

* Write an assembly program that converts a value from hexadecimal to binary coded decimal and to ASCII formats.

**Files Needed:**

* None

**Introduction:**

We have mostly been using hexadecimal to store values in memory. This method requires the fewest number of bits to store a given value. For example, 6553510 is “FF FF” and requires two bytes in memory. However, this is not a convenient format for reporting the number to a human user.

One common user-friendly format is binary coded decimal (BCD). This method stores each digit of the decimal number as a four-bit value, which encodes two decimal digits per byte. This makes the value appear to a human as the decimal representation but the cost of space. Storing the value 6553510 in memory appears as “06 55 35”. This format is often used in conjunction with 7-segment LED displays.

Another common format is ASCII (American Standard Code for Information Interchange). In ASCII, each item is given a 7-bit code that is often stored as a 1-byte hexadecimal number. ASCII has codes assigned to letters, numbers, and non-printable items like backspaces and carriage returns. This method is used to communicate with devices like text-based terminals and printers. Note that the other systems represent the value of the number being stored while ASCII represents the appearance of the number. In the hexadecimal representation for the ten numbers in ASCII, the first digit is a “3” and the second digit is the number. For example, storing 6553510 in memory appears as “36 35 35 33 35”.

Follow the instructions in the CodeWarrior Project Guide to create a new project for this lab. Write an assembly program that meets the following requirements.

1. The program must convert the 2-byte hexadecimal number to a 3-byte BCD number. The address of the hexadecimal number is supplied at address $3000, and the address of the BCD number is supplied at address $3010.
2. The program converts the 2-byte hexadecimal number to a 6-byte ASCII string. The address of the hexadecimal number is supplied at address $3000, and the address of the ASCII number is supplied at address $3020.

The ASCII string must store leading 0’s (value $30) if needed.

After the last ASCII byte that represents a number (only 5 bytes are needed), the program must store $00. For example, if $00FF is supplied as the hexadecimal number, your program should store the bytes “30 30 32 35 35 00”.

Note that all inputs are addresses pointing to the numbers, not the numbers themselves.

**Deliverables/Scoring:**

Successful video demonstration of the program is required for acceptance of the lab report, then

* 10 points - Compliance with posted lab report guidelines.
* 90 points – Assembly code for the program.

Submit the deliverables according to the lab report guidelines posted on Blackboard. Note that a PDF report with the code and an assembly file must be submitted in a ZIP file.