

CS 218

Homework, Asst. #6

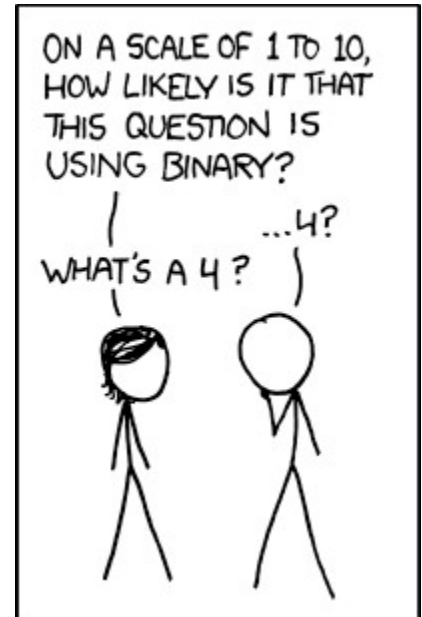
Purpose: Become familiar with data conversion, addressing modes, and assembly language macro's.
Due: Wednesday (6/15)
Points: 75

Assignment:

Write a simple assembly language program to calculate the areas of a cube for each cube in a series of cubes. However, the data is provided in binary¹/ASCII format.

Write two macros; one to convert binary/ASCII to decimal and the other to convert decimal to binary/ASCII.

- Write a macro, **abin2int**, that will convert an ASCII string (up to 32 characters, NULL terminated) representing an unsigned binary value into a double-word sized integer. The macro arguments are starting address of string and integer (for result). *Note*, in order to convert a series of strings, this macro will be called repeatedly by the main.
- Write a macro, **int2abin**, that will convert an unsigned double-word sized integer into an ASCII string representing the binary value (32 characters). The macro must store the result into an ASCII string (32 characters, NULL terminated).



Source: www.xkcd.com/953

The ASCII strings are 32 characters followed by a NULL. All data must be treated as *unsigned* integers (i.e., no negative numbers). As such, the MUL and DIV instructions should be used (not the IDIV, IMUL, or CDQ, etc.).

You will be provided a program template that invokes the macros for each set of data. No changes to the macro parameter lists are allowed. Use the provided data sets. You may declare additional variables as needed. Do **not** change the data types (double-words, words, or bytes) as defined.

The provided main will also invoke a provided print string macro, which will display the strings to the screen. The print macro does not perform any error checking, so the data must be correct in order for the display to work. *Note*, since the program displays the results to the screen, typing the program name (without the debugger), will display the results to the screen once the program is working.

Submission:

When complete, submit:

- A copy of the source file via the class web page (assignment submission link). Assignments received after the due time/date will not be accepted.

¹ For more information, refer to: https://en.wikipedia.org/wiki/Binary_number

Debugging

The code for a macro will not be displayed in the source window. In order to see the macro code, display the machine code window (**View** → **Machine Code Window**). In the window, the machine code for the instructions are displayed. However, the step and next instructions will execute the entire macro. In order to execute the macro instructions, the **stepi** and **nexti** commands must be used (inside the macro code). The following base conversion web page may be useful during debugging; (<http://www.binaryhexconverter.com/binary-to-decimal-converter>).

Example Output:

The results, as displayed to the screen, would be as follows:

```
ed@ed-vm% ./ast6

-----
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Cube Area Information

Cube Sides's:
0000000000000000101001110101100110 000000000000000001010100101010110
000000000000000010101110010110100110 00000000000000000010100101011000
000000000101100000010000001010110 00001010100000100111101101110110
00000000000011000011001001110110 00000010110100011110000110000000
00000101011011100110000000100110 00001001001100000110110011110110
00010011000001010111111000110110 00000011010011100001100000000000
00000011111100011011110100100110 01001111100101000000011110010110
00000001010001010100111010110110 00101111011001010010000110000000
00010100011000010101101000110110 00001001110101101001111000110110
01010101110000001111111000110110 00001001110001110100011001110110
000011100000011100000111000110110

Cube Area's Sum: 01000011000011111110100100001110
Cube Areas's Ave: 00000011001100011000010100000000
Cube Areas's Min: 0000000000000000000010100101011000
Cube Areas's Max: 01010101110000001111111000110110
```

Assignment #6 - Data

Refer to the provided main for the provided data sets.

Debugger Commands:

Below is an example of some of the commands to display some of the variables within DDD for assignment #6. You will need to include the rest.

```
x/21s &cSides
x/21uw &cubeAreas
x/uw &cubeAreasSum
x/uw &cubeAreasAve
x/uw &cubeAreasMin
x/uw &cubeAreasMax
```

Note, in DDD, you can select **View** → **Execution Window** to display a separate window that shows the output (which would normally be displayed to the screen).