Introduction to Computer Engineering (E85)
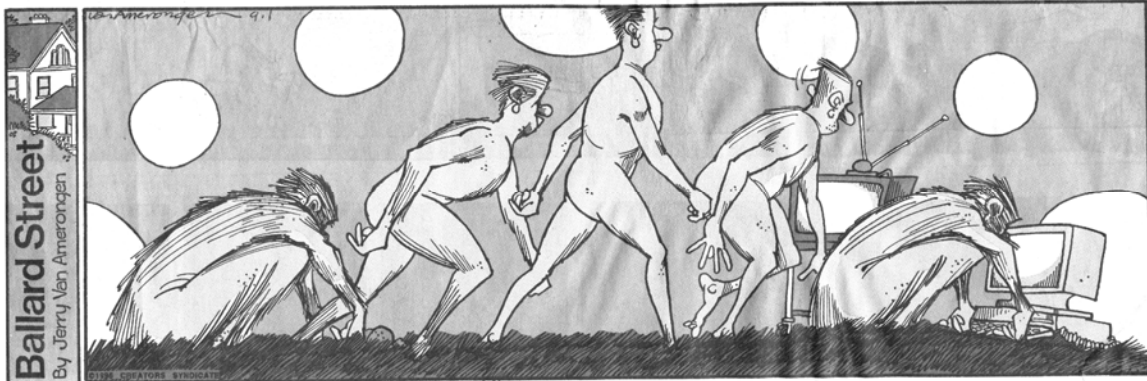
Harris   Fall 2010

Problem Set 7   **Due: Wednesday, November 3**

You may wish to use the MPLAB simulator to test your programs in this problem set.

1) String Manipulation

Write a procedure in C that concatenates (joins together) the two strings:

```
void concat(char[] string1, char[] string2, char[] stringconcat)
```

The procedure does not return a value. It concatenates `string1` and `string2` and places the resulting string in `stringconcat`. You may assume that the character array `stringconcat` is large enough to accommodate the concatenated string.

Keep a copy of your code; you will use it on the next assignment.

2) Fixed Point Multiplication

Write a function to perform signed fixed-point multiplication:

```
short int fixptmul(short int a, short int b)
```

The inputs and outputs are 16-bit 2's complement fixed-point numbers with 8 fractional bits and 8 integer bits.

    a) Express 5.25 in this fixed-point format.

    b) Express -1.125 in this fixed-point format.

    c) Write `fixptmul` in C.

3) Complex Multiplication

Write a function to perform complex multiplication.

```
void complexmul(short int a[2], short int b[2], short int prod[2])
```

The inputs and outputs are pairs of fixed point numbers, as defined in the previous problem, representing the real and imaginary portions of the complex number (the real part is in element 0 and the imaginary in element 1). Your function should use `fixptmul`.

4) Discrete Fourier Transform

Write a function to compute a N-point discrete Fourier transform:

```
void dft(int N, short int a[][2], short int X[][2], short int w[2])
```

The inputs (a) and outputs (X) are arrays of N complex numbers in fixed point format. w is also a precomputed fixed point number equal to $e^{j2\pi/N}$. N <= 1024. Your function should use `complexmul`.

5) Time

Please indicate how many hours you spent on this problem set. This will not affect your grade, but will be helpful for calibrating the workload for next semester's class.