## C Programming Primer for EE 355

This document is meant to serve as an introduction for programmers new to the C programming language. It will be a useful reference for most of the programming assignments in the EE 355 class.

### Header Files
- stdlib.h    - Memory allocation,  Strings to number conversion
- stdio.h     - File input/output, Screen
- math.h      - All math functions.
- complex.h   - Complex number support
- four1.c     - Program from class website for FFT computations
- string.h    - String manipulation (If needed)

### Example File for File I/O

/\* This file reads in a file with 2048 float values, computes its square root and writes the values to a new file. It is assumed that all values that are read in are positive. \*/

```c
#include <stdio.h>         //Header File
#include <math.h>          //Header File
int main(){                //Main function
FILE *file1;               //Pointer to the input File
FILE *file2;               //Pointer to the output File
float a[2048];             //Declaration of Floating point Array.
float b[2048];             //Declaration of Floating point Array.
int i;                     //Declaration of Integer.

file1=fopen("infile","r");  //Open file. "r" indicates readonly.
File2=fopen("outfile","w"); //Open file. "w" indicates writeonly.
fread(a,sizeof(float),2048,file1); //Actual reading of file.

//Computation of square root.
for(i=0; i<2048; i++){
     b[i]=sqrtf(a[i]);
}

fwrite(b,sizeof(float),2048,file2); //Actual writing to file.
fclose(file1);                       //Closing the file.
fclose(file2);                       //Closing the file.
return 0;                            //Return control.
}
```

### Example File for Complex number computations.

```c
#include <stdio.h>
#include <complex.h>

int main(){
```

```
  complex float w,x,y,z;
// Replace with _Complex float w,x,y,z; if compiler complains.
  x=3.2+0.8i;
  y=conjf(x);
  z=x*y;
  w=x;
  w=3.;

  printf("%f %f \n",crealf( w),cimagf( w));
  printf("%f %f \n",crealf( x),cimagf( x));
  printf("%f %f \n",crealf( y),cimagf( y));
  printf("%f %f \n",crealf( z),cimagf( z));

  return 0;
}
```

- The "complex" ensures that two units of float are now treated as a single entity – real value and imaginary value.
- You can interchangeably treat such arrays as complex arrays or float arrays, using a suitable casting. For example, you can pass the "complex float" array named "inputarr" to the function "four1" as follows:
  four1((float*) inputarr - 1, fftlength,1)


**Programming resources**

- We strongly recommend that you use Unix/ Linux based machines for programming in this class. Stanford provides excellent free computing resources. For more details visit http://www.stanford.edu/services/unixcomputing/.
- "bramble" and "hedge" are two good 64-bit machines that can be used for the programming tasks. These machines also have MATLAB installed.
- If you want to program on your PC instead and do not want to use public computing resources (Strongly not recommended), Bloodshed C/C++ (http://www.bloodshed.net/devcpp.html) is a good light weight and sturdy compiler. It also includes a good GUI for programming and debugging.
- Cygwin (http://www.cygwin.com/) is a good linux-like environment for Windows and has a GCC compiler for use with your laptop. Setting up cygwin correctly can be a task by itself. Do not try this if you are not familiar with linux.
- Stanford CS Education Library: http://cslibrary.stanford.edu/101/
- Another good tutorial: http://www.iu.hio.no/~mark/CTutorial/CTutorial.html
- Google is a good resource for identifying problems and making sense of the error messages. You will be surprised by the number of people who have faced the same problems with programming before you.