CSC112 Spring 2011
Fundamentals of Computer Science
Lab 6 – Binary files (continued), 2-D Arrays

In this lab we will build upon last week's lab using arrays. Create a directory named Lab6. Keep all of your source and compiled programs in the directory Lab6.

2-D Dynamically Allocated Arrays

In this exercise, we will write a C++ program to flip a picture upside-down. To this end, there are some details.

1. Download a file named "tux.dat" from:

   http://menehune.opt.wfu.edu/CSC112/Lab6/tux.dat

2. This file is a binary file which represents a black and white image of a familiar character as a matrix of double precision values (base type double). It has the following format:

   (a) The first 4 bytes are an integer m indicating the number of rows of data.

   (b) The next 4 bytes are an integer n indicating the number of columns of data.

   (c) The next $8 \times m \times n$ bytes represent a matrix of $m \times n$ double precision values (base data type `double`) in **column major order**.

   To read this file, you will need to first read m and n, and then allocate an array to hold the rest of the data from the file.

   There are several ways to implement 2-D arrays in C++. The one recommended for this lab is to create the 2-D array as an array of 1-D arrays (matrix rows). To do this you will need to declare a pointer to a pointer. For example:

   ```
   double ** a ;
   ```

   To allocate memory for this kind of structure, you must dynamically allocate each row. Once the matrix is allocated, you can reference row `i` and column `j` using the syntax `a[i][j]`.

3. To view this file:

   (a) Download a program named `dat2ppm` from:

   http://menehune.opt.wfu.edu/CSC112/Lab6/dat2ppm

   Make sure the execute permissions are set correctly for `dat2ppm` and put it in `/usr/local/bin`.

   (b) Use the command

   ```
   dat2ppm -gray tux.dat
   ```

   to create a ".ppm" graphics format file.

   (c) Use the command "`display tux.ppm`" to view the image.

4. After you have read the data file into a 2-D array, flip the image upside-down. To do this, loop over all columns of the matrix, and in each columns, reverse the columns. This is similar in concept to reversing the audio samples in Lab 5.

5. After you have flipped the image upside-down, write it to a data file named **tux_ud.dat**. Use the same data format as described for the input file.

6. You should use `dat2ppm` and `display` to verify that the image has been processed correctly.

Turn in: Change to the directory containing the sub-directory "Lab6" Create a file named "lab6.tar" using the command:

```
tar cf lab6.tar Lab6
```

Upload the file "lab6.tar" to your account on telesto.