



Project 1

C Programming

Programming Language Concepts

Fall Quarter 20071

Due Dates

Project 1 is due on Sunday, 9/23/2007. It will be accepted if late with a 20% per day penalty. As an example, if the project is turned in even one minute late on Monday morning, it will receive a maximum grade of 80%. On Tuesday morning the maximum grade will go down to 60%.

Assignment

Several Java classes will be given to you with this project. They build a Queue class with a linked list. You can get a copy of the Java source code for the programs from the unix directory: `~jdb/share/c/*.java`

Note that your solutions must run on the Sun machines. Things you are required to do:

1. Convert the Node class into a C structure for a node. For convenience, you may make the next node a void pointer.
2. Convert the Queue class into a C queue. It should be in the same file as the node structure (called Queue.c) and all of the private variables in the Queue class should be encapsulated in the Queue.c file. To make things a little easier, you may assume that all data is of integer type for printing and that the findElement function has a prototype of:

```
int findElement( int element );
```

3. Write a Queue.h file with function prototypes for the C queue.
4. Translate the TestQueue class into C. Put the translation into a file called TestQueue.c. Please use the clock() function for timing in TestQueue. As an example:

```
#include <time.h>
...
clock_t beginningTime = clock();
...
clock_t totalTime = ((double)clock()- beginningTime)/CLOCKS_PER_SEC;
```

5. Answer the following questions and put them in a plain text file called questions.txt. Please **DO NOT** compile your programs with optimization turned on. You may increase the size of the data set in order to see differences more easily.
 - a. Which is faster, the C or Java program? Please explain your answer.
 - b. When all print statements are removed, which program is faster? Please explain your answer.
6. Now, time only the findElement function for several runs and add the answers to the following question to questions.txt:
 - a. Which is faster, the C or Java program? Please explain your answer.

7. findElement was originally created as each element pair is an index followed by a value (0 value) (1 value) ...). findElement returns the node index of the data set that an element is in, but does not search the indices of the elements inside of a data set. Now, using information from class, try to create a faster version of a C queue that can find elements. All data within a node must still exist, but may be reordered. You may also try techniques such as pointer arithmetic and unrolling loops. You may also consider larger data sets in order to bring out any differences in your program versions.

8. Answer the following questions in detail and append them to your questions.txt file:
 - a. How much faster have you been able to make your C program?
 - b. Is the C program as fast as the original versions that have been compiled with optimization turned on?

What to Submit

You are responsible for making sure that your code works on the sun machines. If you use a makefile, please include it with your code. All code will be run compiling with gcc unless other instructions are given. Code will not be compiled or tested upon submission. Please submit using the following:

- a. Sign up for my PLC course with wtry at: <https://doji.cs.rit.edu>. Both undergraduate and graduate students should sign up for course 450 section 2. You need to login using your DCE account information.
- b. Submit all of your code and the questions.txt file to the appropriate project and task.