CSC 210, Exam One
Section 003
16 September 1998

Name

Unity/Eos ID

1. This exam is written with 100 points.

2. Please put your Eos/Unity username at the top of each page.

3. Do not put your SSN or SID anywhere on this exam.

4. The exam contains 4 pages. Please check to be sure your copy of this exam contains pages 1 through 4 and problems 1 through 7.

5. Comment your code only if you’re not sure about it.

6. Use the space provided for each problem to write your answer. If there’s not enough room, you may continue your answer on the back of the current or previous page, but please indicate that you have done so.

7. Read each problem carefully before working on it. Better yet, read through the whole exam before working on anything and then decide what to work on first.

On my honor: I affirm that I have not and will not use any external sources of assistance (notes, another student’s examination form, etc.) during this examination. I have not sought, used, or plan to use information obtained from student(s) who took a CSC 210 exam earlier today, nor will I give information about this exam to any student until after 8:00 PM, Thursday, September 17. I am the student whose name appears on this exam.

Signed: ____________________________________________

Date: ______________________________________________

Failure to sign this form legibly will result in a zero score on this exam.
Arrays, Strings, Command Line Arguments, and File I/O

1. [25 points] Suppose you are involved in writing a simple compiler: it is invoked by the command
   compile file.cpp, where file.cpp is a C++ source file, and it produces an object file called file.o.
   Your task is to write a main program that does the following: (a) reads the name of the source file
   from the command line and opens an input stream for it, (b) creates the name of the object file
   (you can write a separate string function to do this, but you may not use the library functions in
   string.h), (c) opens an output stream for the object file, and (d) calls a function with prototype
   cpp_compile(istream & in, ostream & out); to do the actual compilation.
   Errors in the command line or the files should be handled by printing a short, informative message
   and exiting. To keep this problem simple, you are allowed to assume that the input file name has
   only one dot and that this is followed by cpp. Just write the main function — no need to put in
   all the #include directives.
   [10 points for converting the file name, 5 points each for command line argument handling, opening
   streams, and error handling.]
**Finite-State Machines and Horner’s Rule**

2. **[10 points]** Show all intermediate steps of using Horner’s rule to convert the string of bits (binary “digits”) 1011001110 to an integer. Do not write any C++ code — just compute the correct integer and show all the steps.

3. **[25 points]** Draw a “bubble diagram” for a finite-state machine that converts alphabetic characters between a pair of $’s to upper case. A backslash \ is used as an “escape character” — any character that follows is output literally. So $ can be used to output $, \ can be used to output \, and \a will cause a to be output. For example, the input abc$abc\$de\$\$a\ will be converted to abcABC$DE\$aa. You can assume that there is no “premature end of input” (that is, every $ that begins an upper-case sequence will have a matching ending $, and every \ used as an escape will be followed by at least one other character). You may use the ctype.h functions isalpha and toupper where appropriate.
Separate Compilation and Makefiles

The questions below refer to the following Makefile:

```plaintext
prog: main.o tools.o Buffer.o; g++ -o prog main.o tools.o Buffer.o
main.o: main.cpp tools.h Buffer.h; g++ -c main.cpp
tools.o: tools.cpp tools.h Buffer.h; g++ -c tools.cpp
Buffer.o: Buffer.cpp Buffer.h; g++ -c Buffer.cpp
clean: ; rm *.o prog
```

4. [12 points] Suppose prog is up to date. List the commands that would be executed as a result of each of the following (touch file has the same effect as making a change in file):

(a) touch Buffer.h; make prog

(b) make clean; make prog

(c) touch Buffer.cpp; make prog

(d) touch tools.h; make prog

5. [12 points] In which of the four stages of program evolution (preprocess, compile, link, or execute) would each of the following errors be identified (if at all; errors that might cause unpredictable behavior during execution should be labelled as execute; any sort of warning also counts as identification of the error). Explain your answer if you wish to receive partial credit.

(a) In main.cpp you declare an array char A[25]; and your program contains the statement A[i] = 0; inside a loop whose header is for ( int i = 0; i <= 25; ++i ).

(b) Your main.cpp contains the directive #include"Buffer.cpp".

(c) There is an #include"tools.h" in main.cpp, the prototype void change_name(char dest[], const char src[]); appears in tools.h, the code in main.cpp calls change_name with two string arguments, and the only definition of change_name in tools.cpp begins with void change_name(char name []).

(d) Same as part (c), but tools.h has void change_name(char name []); as the only prototype of change_name.

Score on this page_____
Classes

6. [10 points]
Consider the following declaration for a `Counter` class with three methods: a constructor, a function that increments the counter by a specified value, and a function that returns the current value of the counter:

```cpp
class Counter {
public:
    Counter(int value = 0);
    void inc(int by = 1);
    int val() const;
private:
    int my_value;
};
```

Write the code required for each of the following (details of syntax are important on this question).
(a) Definition of the constructor (the argument specifies the initial value of the counter):

(b) Definition of the `inc` method:

(c) Declaration of a `Counter` instance called `wc` with initial value 5:

(d) Statement in client program to insert the value of the counter `wc` into `cout`:

(e) Statement(s) in client program to set `wc`'s value to 7 regardless of what its current value is:

7. [6 points] Describe what role each of the following play in a program.
(a) Instance (of a class):

(b) Constructor:

(c) Method:

Score on this page_____