1.12 Computer Models of Physical and Engineering Systems **Spring 1994**
FINAL EXAM **9 A.M. Monday, May 16, 1994**

Instructions:

- **Write your name** on each one of the pages that you use for your exam.
- There are a total of **4 problems** and **1 extra problem** allowing you to get maximum 140 points out of this final. Only do the extra point if you finish the first 4 required problems.
- You have a total of **3 hours** to complete the final exam.
- **ASK** for clarification if you do not understand **ANY QUESTION**.
- Use the tables as you best fit. **Use quotes** in order to avoid repeating information when applicable.
- This final exam is **OPEN BOOK** and **OPEN NOTES**.

Problem #1: [20%]
(Object-Oriented General Knowledge)

Prepare a table of all the object-oriented modeling techniques covered in class. Please write down the name of the model, its use, its constructors (objects, classes, role, state, etc.), and its characteristics.

Name of Model	*Use of Model*	*Constructors*	*Characteristics*	*Constructors*	*Characteristics*

Extra Page for Problem #1:

Name of Model	*Use of Model*	*Constructors*	*Characteristics*	*Constructors*	*Characteristics*

Problem #2: [20%]
(Numerical Method General Knowledge)

Prepare a table of all the numerical methods covered in class. Please write down the name of the method, its use, its error order, and its characteristics. Remember that we covered methods for interpolation, derivation, integration, ordinary differential equations, and partial differential equations (these are the category for the method use). Remember that most methods had an error order that was represented as $\mathcal{O}(h^n)$. In some cases, we have local errors and global errors. Please write on the error column which error is appropriate to the method. Important characteristics are if the method is single or multiple-step depending on the number of previous points needed in order to apply the method. Other important characteristics are stability of the method, easiness to change the step size of the method, and other limitations.

Name of Method	*Use of Method ....*	*Error ....*	*Important Characteristics ....*

Extra Page for Problem #2:

Name of Method	*Use of Method ....*	*Error ....*	*Important Characteristics ....*

Problem #3: [20%]
(Fractals and Chaos General Knowledge)

Prepare a table of all the fractals, attractors and chaos representation covered in class. Please write down the name of them, its class (it is a fractal, an attractor, etc.), its construction process, and the characteristics (dimension, etc.). If you can draw a graph of each one please do so.

Its Name......	*Its Class..*	*Construction Process..*	*Characteristics.........*	*Small Graph ....*

Extra Page for Problem #3:

Its Name......	*Its Class..*	*Construction Process..*	*Characteristics.........*	*Small Graph ....*

Problem #4: [40%]
(Applied Knowledge)

Prepare a problem set for this class. Take into consideration all the material covered in class. Also take into consideration, the complexity of the problem, the relevance of the problem (the problem should be interesting), the points to be learned from the problem set, the technique to be used, and the time that it will be needed to be completed. Give as much detail as you can and explain the concepts that you want the student to learn.

Extra Page for Problem #4:

Extra Page for Problem #4:

Problem #5: [40%]
(Extra Point on C++)
Work on this problem if and only if you have finished everything else.
You will not get these points if your solutions to previous problems are incomplete or badly done.
The solutions to previous problems have to show serious thought and completeness.

Solve the problem set that you generated and write down the code that will implement it. Please, follow the C++ syntax as if you were going to run this code in a computer.

Extra Page for Problem #5:

Extra Page for Problem #5: