

Elizabeth City State University
ONR-AASERT
Summer 1996 Research Teams

Dr. Linda Bailey Hayden, Principal Investigator

Fractals/Chaos with Mathematica Team

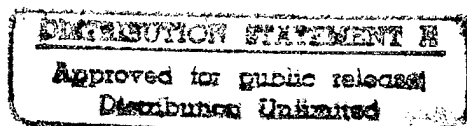
Dr. Manglik, Mentor
Timothy McCray, Graduate Student-CS
Lakesha Mundon, Sophomore-Math
Tammara Ward, Junior- Math
Tanisha Cowell, Junior-CS

ATM Networking Team

Dr. Linda Hayden, Mentor
Mr. Darnley Archer, Mentor
Mr. Wayman White, Mentor
Sharon Saunders, Graduate Student-CS
Derrek Burrus, Sophomore-CS
Shanita Powell, Sophomore-CS
Curtis Felton, Junior - CS/Chem
Antonio Rook, Sophomore-CS

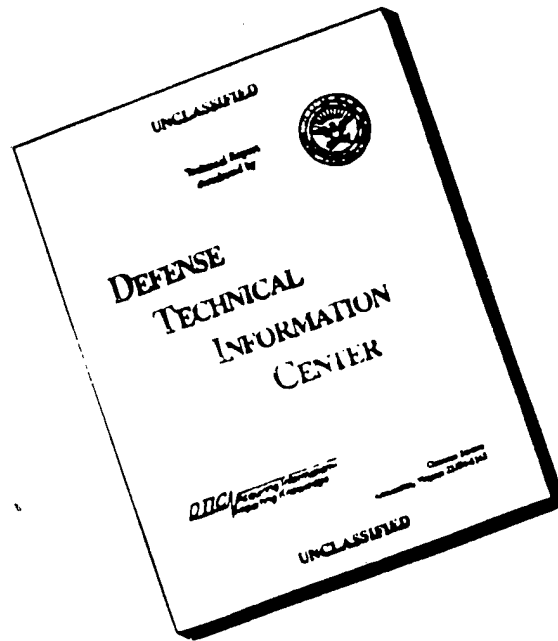
HTML/JAVA

Dr. Linda Hayden, Mentor
Mrs. Tracy Chamberlain, Mentor
Michelle Brown-Emmanual, Graduate Student-CS
Marie Dail, Graduate Student-CS
Kimberly Wright, Sophomore-CS
Kuchumbi Hayden, Sophomore-CS
Reginald Turner, Senior-CS
Courtney Fields, Sophomore-CS
Makeba Fussell, Senior-CS



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REPORT DOCUMENTATION PAGE

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6. AUTHOR(S) Dr. Linda Hayden			8. PERFORMING ORGANIZATION REPORT NUMBER: 5-52562 5-52561	
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13. ABSTRACT (Maximum 200 words) The AASERT Summer Research Program is part of a trio of programs at ECSU funded by ONR. They include the parent grant Nurturing ECSU Research Talent (NERT), NERT-I (Instrumentation) and Augmentation Award for Science and Engineering Research Training (AASERT). The AASERT grant provides funds for the summer component while NERT-I provides instrumentation for both NERT and AASERT. Student development activities have included the following a) Recruitment of high ability minority students; b) Providing a summer program for recruited students; c) Providing research experiences; d) Providing a mentor, graduate school counseling and GRE preparation; e) Providing financial support for students in the form of research assistantships; and f) Providing funds for student travel. This report documents the summer research activities of the NERT and AASERT program.				
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About the Program.....

This program, entitled Nurturing ECSU Research Talent (NERT) focuses on undergraduate education and undergraduate research experiences.. Nurturing these young researchers is our primary concern. Highest priority is given to providing them with the guidance and skills to insure their entrance and success in graduate school. Further, each student in our program learns the fundamentals of scientific research as they conduct investigations in HTML/JAVA, Asynchronous Transfer Mode Networking and Fractals/Chaos.

AASERT Summer Research program is part of a trio of programs at ECSU funded by ONR. They include the parent grant Nurturing ECSU Research Talent(NERT), NERT-I(Instrumentation) and Augmentation Award for Science and Engineering Research Training(AASERT) . The AASERT grant provides funds for the summer component while NERT-I provides instrumentation for both NERT and AASERT.

Student development activities have included the following: a) Recruitment of high ability minority students b) Providing a summer program for recruited students; c) Providing research experiences; d) Providing a mentor, graduate school counseling and GRE preparation; e) Providing financial support for students in the form of research assistantships; and f) Providing funds for student travel.

This program also strengthens the infrastructure of the Mathematics and Computer Science Department of ECSU. Activities which address infrastructure have included a) Enhancement of current computer graphics and operating systems courses; b) Development of a new courses c) Acquisition of computer equipment appropriate to support of student research; d) Establishing a visiting lecture series in computer science and mathematics; e) Hiring a UNIX network manager.

ECSU is a small school that makes a big effort to nurture their students. I am proud to part of the mentoring effort. It has been my pleasure to work with these young people who are preparing themselves to assume future leadership roles within the technical ranks. May they continue their quest for knowledge and excellence!

*Dr. Linda Bailey Hayden,
NERT Principal Investigator*

Office of Naval Research
AASERT Summer'96 Research Program
June 24, 1996 - August 2, 1996

Dr. Linda Hayden, Principal Investigator

This ONR-AASERT research project, at ECSU, supports undergraduates and precollege students in our summer research training. All students hired under this research project investigate a mathematics or computer science topic. Each will also develop a personal Homepage.

Undergraduate Computer Science majors must be full time ECSU students with a minimum 2.75 overall GPA, 3.0 GPA in their major courses and must be recommended by two of their major professors. The undergraduates will work in the laboratory for 6 hours each day, 5 days each week for 6 weeks.

Precollege students selected have completed a minimum of three credits of mathematics including geometry and algebra II. Grades of B or better in these courses plus recommendation of two science/mathematics teachers will be required. The precollege students will work in the laboratory for five weeks, 6 hours each day, 5 days each week. All students, both precollege and undergraduate must be citizens of the United States.

Student Salaries: Precollege students receive \$7.00/hr. Undergraduate students get \$8.00/hr.

Planned Activities

- Lectures by visiting consultants
- Bi-weekly Progress Reports: Fridays 1:00pm - 2:30pm
- Final Research Project Reports
 - Final Oral Reports and Final Written Reports: Aug. 2, 1996
- Conference Travel
 - ADMI conference Mayaguez, Puerto Rico, July 25-28, 1996
- Faculty Mentors
- Graduate School Assistants

Summer 1996 Research Teams

Elizabeth City State University

Dr. Linda Hayden, Principal Investigator

<u>TEAM NAME</u>	<u>MENTOR</u>	<u>GRAD STUDENT(S)</u>	<u>ECSU STUDENTS</u>
Fractals/Chaos with Mathematica	Dr. Manglik ✓	Timothy McCray **	Tammara Ward ✓ Lakisha Mundon *
HTML/JAVA	Mrs. Tracy Chamberlain	Marie Dail Michelle Brown **	Courtney Fields* Reginald Turner ✓✓ Kimberly Wright*** Makeba Fussel ✓✓ Kuchumbi Hayden *
ATM Networks	Mr. Darnley Archer Mr. Wayman White	Sharon Saunders **	Antonio Rook * Curtis Felton ✓ Derrek Burrus ✓ Vara Powell ✓

Contract Dates

* May 13-Aug 2

**May 20 - Aug 2

*** May 7 - Jul 19

✓ June 24 - Aug 2

✓✓ June 24 - July 19

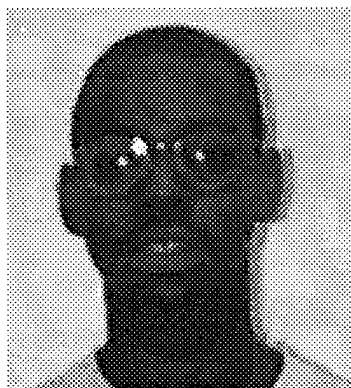
1996 SUMMER RESEARCHERS



Antonio Rook



Courtney Fields



Curtis Felton



Darnley Archer
Mentor



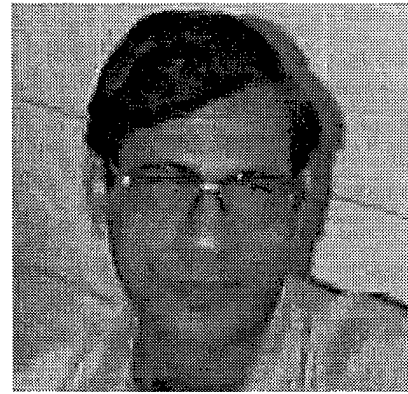
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Reginald Turner



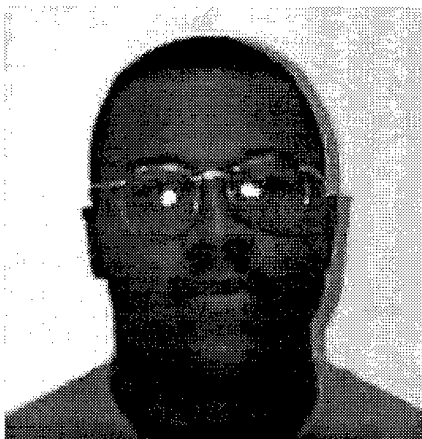
Wayman White
Mentor



Dr. Vinod Manglik
Mentor



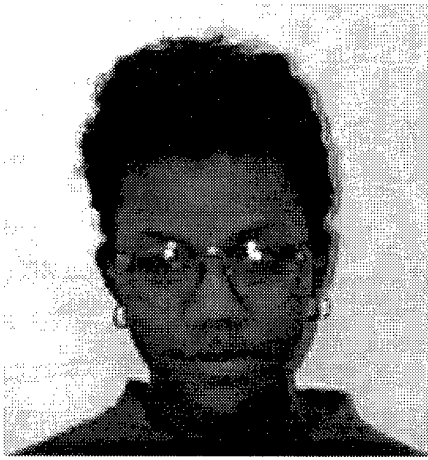
Tracy Chamberlain
Mentor



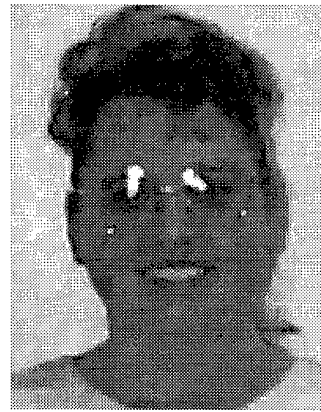
Timothy McCray
Graduate Student



Sharon Saunders
Graduate Student



Shanita Powell



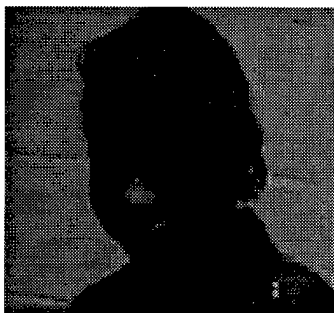
**Marie Dail
Graduate Student**



Kuchumbi Hayden



Tammara Ward



Kimberly Wright



Tanisha Cowell

1996 SUMMER RESEARCH GROUPS

Back row: Courtney Fields, Reginald Turner, Kuchumbi Hayden
Front Row: Tracy Chamberlain, Makeba Fussell, Michelle Brown-Emmanual



1996 SUMMER RESEARCH GROUPS

Tanisha Cowell, Timothy McCray, Tammara Ward
No Photo: Lakesha Mundon, Dr. Manglik



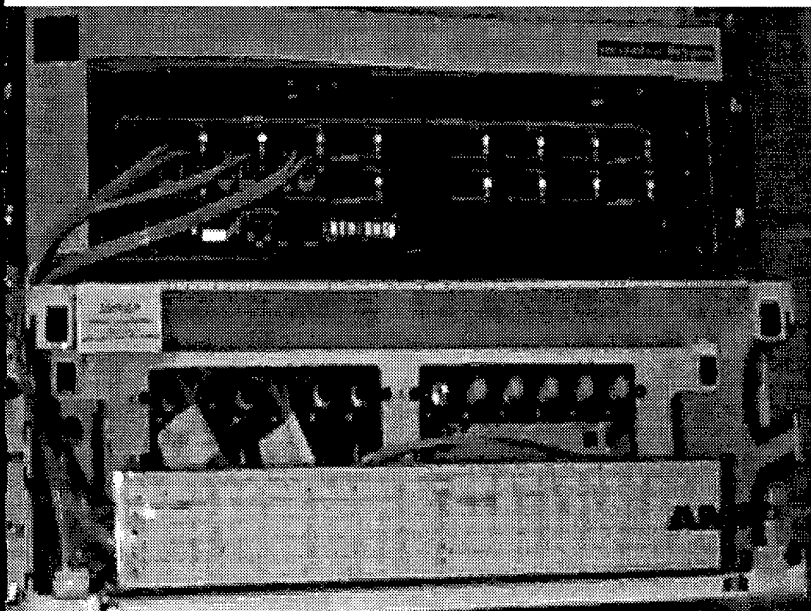
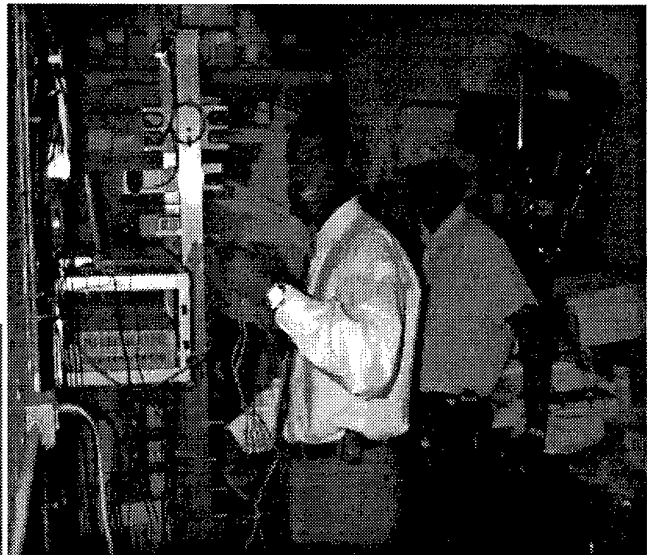
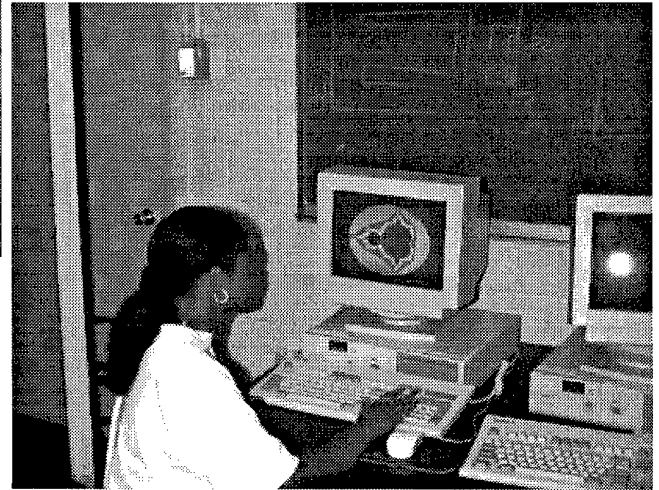
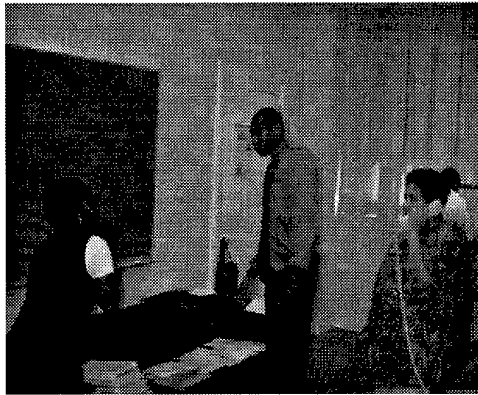
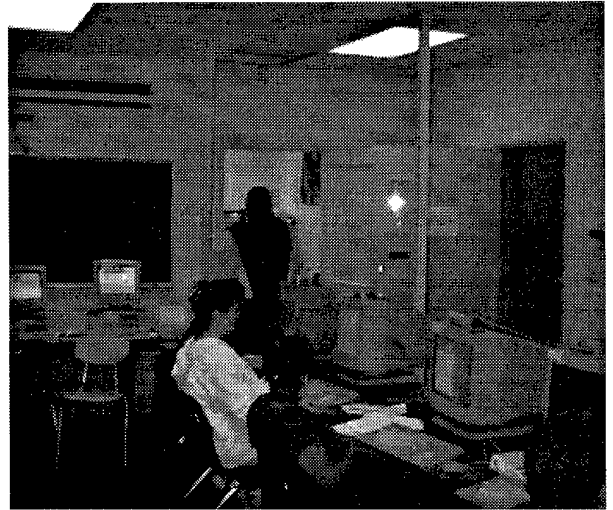
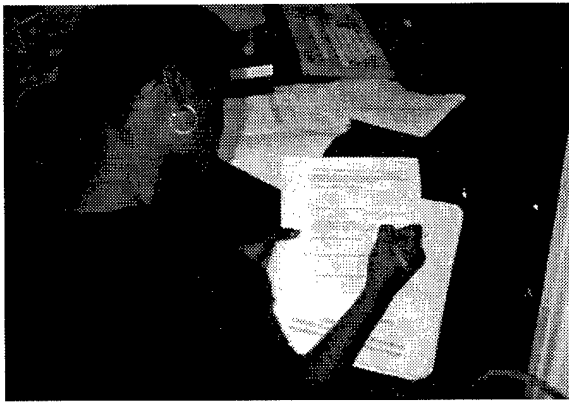
Back Row: Wayman White, Shanita Powell, Curtis Felton, Antonio Rook
Front Row: Derrek Burrus, Sharon Saunders, Darnley Archer



1996
Summer
AASERT
Program

Summer of
hard work!!

ATM is here!



Nurturing ECSU Research Talent
Program - ONR
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Elizabeth City, NC 27909
(919)335-3617
LHAYDEN@UMFORT.CS.ECSU.EDU
visit our Website ...
<http://www.ecsu.edu>

Fractals and Chaos
With
MATHEMATICA

Fractals and

Chaos

Researched by:

*Tanisha Cowell
Lakisha Minton
Tammara Ward*

Grad Student:

Timothy McCray

Mentor:

Dr. Manglik

Principle Investigator:

Dr. Linda Hayden

Final Report
Fractals and Chaos Team

Historical Developments

This week, the Fractals and Chaos group began our research by reviewing the first chapter of *Fractal Vision, A History of Fractals and Chaos*, surfing the Internet, working with the computer softwares, Mathematica, and Fractal Vision. We learned about great Mathematicians and philosophers such as Euclid of Alexandria, who "invented Geometry as we know it", or Rene Descartes, who "suggested that our universe could be measured by three intersecting perpendicular poles notched in perfectly even gradation, thus giving everything in existence a precise location in three straight-line dimensions. All of creation, then could be seen as a giant stack of tiny, perfectly cubic boxes." (Descartes' idea became the foundation for most of today's scientific views.) This novel approach to viewing the universe allowed people to perceive the space around them not as objects or events, but in abstract dimensions. Armed with the philosophy of Rene' Descartes, Sir Isaac Newton and Baron Gottfried Wilhelm von Leibnitz invented *differential calculus*. (The purpose of calculus is to turn the curved lines into linear ones. Ergo the equation dy/dx expresses the slope of an infinitesimally tiny line segment.) It was Leibnitz who proposed the idea that "all curves are made up of infinitesimally small line segments", also called tangent lines or differentials. (The only problem with this assumption is that curves resisted being entirely reduced to lines somehow.) From Leibnitz proposed claim, French astronomer Pierre-Simon Laplace voice the belief that "if the position and velocity of every particle in the universe was known, the curvilinear paths of every particle could be predicted with absolute certainty from simple linear equations." Then in the year 1875, a German mathematician Karl Weierstrass described a curve that couldn't be differentiated and therefore had no tangent lines. This caused chain of mathematical experiments to be performed. One example of these experiments is the Sierpinski's Triangle, which is also an example of a fractal. It is a triangle that has different numbers of stages. It starts with a

blank triangle and which is then divided into four equal pieces in the same likeness as the original triangle. This process is repeated over and over again, or iterated, as the frequency of the triangle appears 3^n , and the area becomes $(3/4)^n$. (see appendix) The problem begins when the area of the covered region is to be found. Zero is never reached when finding the area.

Fractals

What then is a fractal? Fractals are rough or fragmented geometric shapes that can be subdivided in parts, each of which is (at least approximately) a reduced-size copy of the whole. Some examples of fractals are: Sierpinski's triangle, Cantor's snowflake, Peano's curve, Mandelbrot set (example in appendix 1) and Lorenz attractor. Fractals are also used to describe clouds, mountains, turbulence, and coastlines, that do not correspond to simple geometric shapes. (It was Benoit Mandelbrot, who invented the word fractal from the Latin adjective fractus. The corresponding Latin verb, frangere, means "to break".)

Strange Attractor

A strange attractor is the limit set of a chaotic trajectory. A strange attractor is an attractor that is topologically distinct from periodic orbit or a limit cycle. A strange attractor can be considered a fractal attractor. Let us consider a volume in phase space defined by all the initial conditions a system may have. For a dissipative system, this volume will shrink as the system evolves in time. (The Liouville's Theorem) If the system is sensitive to the initial conditions, trajectories of the points definite initial conditions will move apart in some directions, closer in others, but there will be a net shrinkage in volume. Ultimately, all points will lie along a fine line of zero volume. This is the strange attractor. All initial points in phase space which ultimately land on the attractor form a Basin of Attraction. A strange attractor results if a system is sensitive to initial conditions and is not conservative. While all chaotic attractors are strange, not all strange attractors are chaotic.

Mandelbrot Sets

Mandelbrot set is a fractal that is generated by a formula where the set of all complex c such that iterating $z \rightarrow z^2 + c$ does not go to infinity (starting with $z=0$). Zero is the critical point of $z^2 + c$, that is, a point where $dz/dz(z^2 + c) = 0$. If you replace $z^2 + c$ with a different function, the starting value will have to be modified. For example, $z \rightarrow z^2 + z^2 + z + c$, the critical point. Thus, testing the critical point shows if there is any stable attractive cycle. The difference between Mandelbrot set and Julia sets is simply Mandelbrot sets iterates $z^2 + c$ with z starting at 0 and varying c , and the Julia set iterates $z^2 + c$ for fixed c and varying starting z values. Meaning that the Mandelbrot set is in the parameter space (c -plane) while the Julia set exist in the dynamical or variable space (z -plane). The connection between the Mandelbrot set and the Julia sets are the point of c in the Mandelbrot set specifies the geometric structure of the corresponding Julia set.

It has been said that if a fractal is self-similar, you can specify mappings that map the whole onto the parts. Iteration of these mappings will conclude in convergence the of a fractal attractor. An iterated function system consists of a collection of affine mappings. If a fractal can be describe by a diminutive number of mappings, the IFS is a very compact description of the fractal. Iterated function systems can be used to make things such as fractal ferns (appendix 2) and trees.

Linear Algebra through Mathematica

The Fractals and Chaos Research team has exploring Mathematica, a general software system for technical computations. The team adventured into the linear algebra (Eigenvalues and Eigenvectors) aspect of Mathematica. Our experimenting lead to the discovery that given an $n \times n$ matrix of real numbers, Mathematica will find the approximate numerical Eigenvalues and Eigenvectors. It also will give the characteristic polynomial.

In addition, Mathematica can calculate other functions related to linear algebra such as singular values, pseudo-inverse matrices, and Jordan decomposition. Once our

Appendix 3) Using affine transformation, we created Sierpinski's Triangle in both 2-D, and 3-D, as well as creating a checker board. (see Appendix 4.5.6)

Chaos

Chaos is apparently unpredictable behavior arising in a deterministic system because of great sensitivity to initial conditions. Chaos arises in a dynamical system if two arbitrarily close starting points diverge exponentially, so that their future behavior is eventually unpredictable. An example of chaos is the weather. It takes just a small variation of the initial conditions to result in radically different weather later.

Linear Algebra through Mathematics

The Fractals and Chaos Research team has exploring Mathematica, a general software system for technical computations. This week, the team ventured into the linear algebra (Eigenvalues and Eigenvectors) aspect of Mathematica. Our experimenting lead to the discovery that given an $n \times n$ matrix of real numbers, Mathematica will find the approximate numerical Eigenvalues and Eigenvectors. It also will give the characteristic polynomial.

In addition, Mathematica can calculate other functions related to linear algebra such as singular values, pseudo-inverse matrices, and Jordan decomposition.

Fractal Vision: Fractals in the Real World

Through Fractal Vision, one is able to view a pictorial image of fractals. The team has been exploring fractals in the real world. In Fractal Vision, the team was able to see the progression of clouds (cirrus and stratus) by modeling the movements of air currents. By modeling the different types of air currents for each type of cloud, the software is able to approximate the shape of the cloud. The team also look at different types of trees (maple and pine) to explore their unique characteristic branching pattern, and furthermore, each leaf pattern. Throughout these experimentations, the team was able to get a better understanding of fractals in the real world.

knowledge of Mathematica was enhanced, we began our project with some affine transformation.

IFS and Affine Transformation

An affine transformation of \mathbb{R}^n is achieved by applying a linear transformation and following it with a translation

IFS 2.334.82

The Mathematics of IFS was developed by John Hutchinson and popularized by Michael Bainsley. IFS replaces polygons by other polygons as described by a generator.

On every iteration, each polygon is replaced by a suitably scaled, rotated, and translated version of the polygons in the generator. It is also possible to derive a hopalong description which gives the image that would be created after iterating the geometric model to infinity.

The description of this is a set of contractive transformations on a plane of the form

$$\begin{pmatrix} x_n \\ y_n \end{pmatrix} = \begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} x_{n-1} \\ y_{n-1} \end{pmatrix} + \begin{pmatrix} e \\ f \end{pmatrix}$$

each with an assigned probability. To run the system an initial point is chosen and on each iteration one of the transformation is chosen randomly according to the assigned probabilities, the resulting points (x_n, y_n) are drawn.

The IFS approach provides a good frame work from which to pursue the mathematics of many classical fractals as well more general types. It is also the frame work from which to make the transition to chaos associated with fractals.

An affine transformation is one that scales time and distance by different factors.

For Example:

$$T(u) = Au + y$$

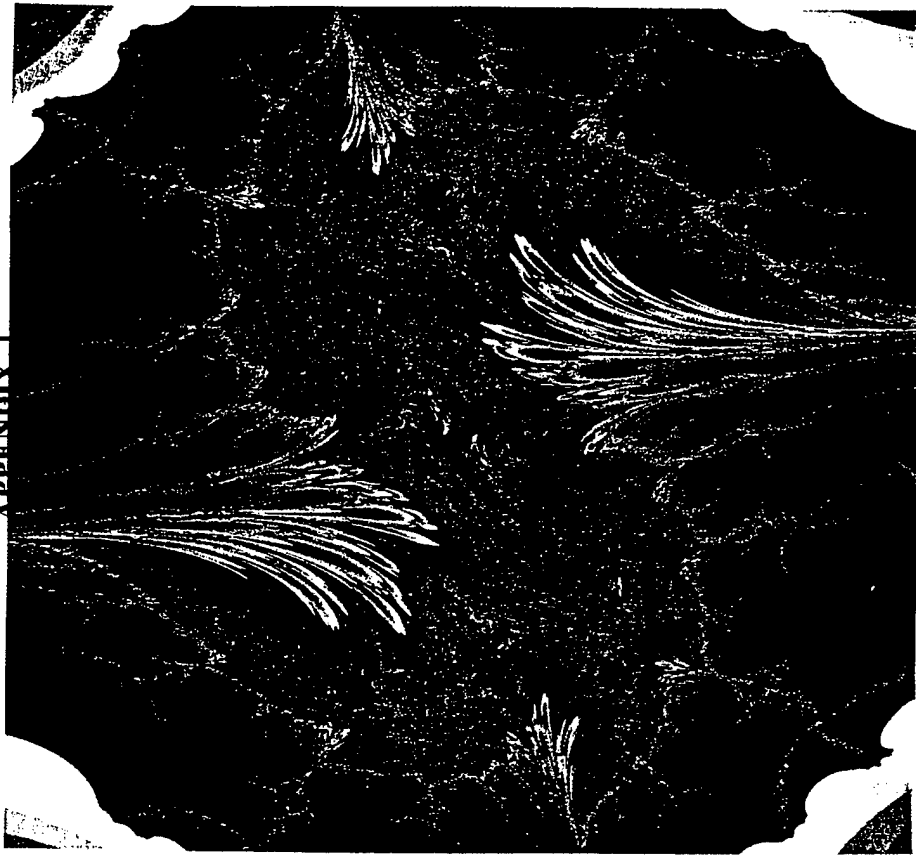
where A is a matrix and y is a fixed vector. An affine

transformation can be interpreted as a matrix transformation followed by a translation. (see

Bibliography

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APPENDIX 1



APPENDIX 2



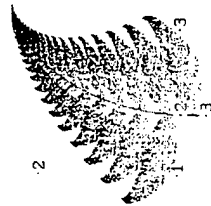
Iterated Function Systems Playground

This page lets you design your own IFS fractal. For help how to operate it, please read the manual.



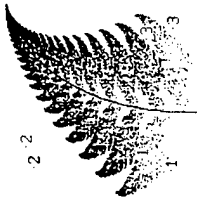
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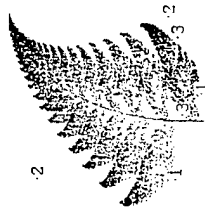
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Transformation 2:



Weight =

Transformation 3:



Weight =

Transformation 4:



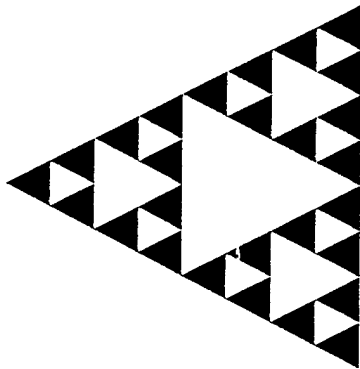
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APPENDIX 5

Fracsum4

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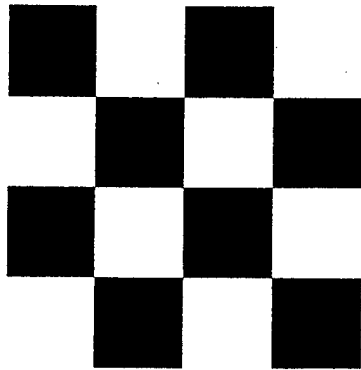
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Fracsum3

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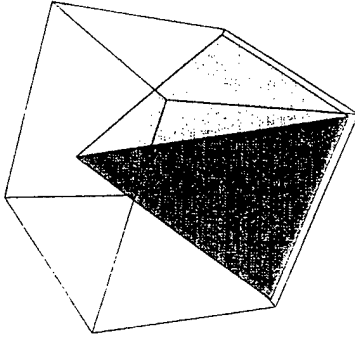


-Graphics-

APPENDIX 6

Fracsum

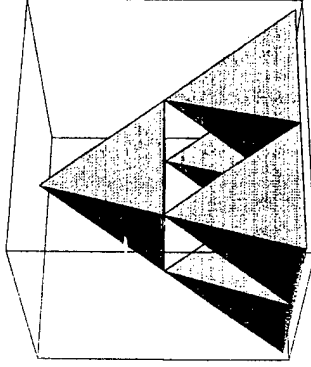
```
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Polygon[{{1,0,0},{1,1,0},{1/2,1/2,1}}],
Polygon[{{0,1,0},{1,1,0},{1/2,1/2,1}}],
Polygon[{{0,1,0},{0,0,0},{1/2,1/2,1}}]}]]
```



-Graphics3D-

Fracsum

```
Show[Graphics3D[{{
Polygon[{{0,0,0},{1/2,0,0},{1/4,1/4,1/2}}],
Polygon[{{1/2,0,0},{1/2,1/2,0},{1/4,1/4,1/2}}],
Polygon[{{0,1/2,0},{1/2,1/2,0},{1/4,1/4,1/2}}],
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Polygon[{{1/2,1/2,0},{1,1/2,0},{3/4,1/4,1/2}}],
Polygon[{{1/2,1/2,0},{1/2,0,0},{3/4,1/4,1/2}}],
Polygon[{{0,1/2,0},{1/2,1/2,0},{1/4,3/4,1/2}}],
Polygon[{{1/2,1,0},{1/2,1/2,0},{1/4,3/4,1/2}}],
Polygon[{{0,1,0},{1/2,1,0},{1/4,3/4,1/2}}],
Polygon[{{1,1,0},{0,1/2,0},{1/4,3/4,1/2}}],
Polygon[{{1/2,1/2,0},{1,1/2,0},{3/4,3/4,1/2}}],
Polygon[{{1,1,0},{1,1,0},{3/4,3/4,1/2}}],
Polygon[{{1/2,1,0},{1,1,0},{3/4,3/4,1/2}}],
Polygon[{{1/2,1,0},{1/2,1/2,0},{3/4,3/4,1/2}}],
Polygon[{{1/4,1/4,1/2},{3/4,1/4,1/2},{1/2,1/2,1}}],
Polygon[{{3/4,1/4,1/2},{3/4,3/4,1/2},{1/2,1/2,1}}],
Polygon[{{1/4,3/4,1/2},{3/4,3/4,1/2},{1/2,1/2,1}}],
Polygon[{{1/4,3/4,1/2},{1/4,1/4,1/2},{1/2,1/2,1}}]}]}],
ViewPoint->{4.000,-2.112,-0.060}]
```



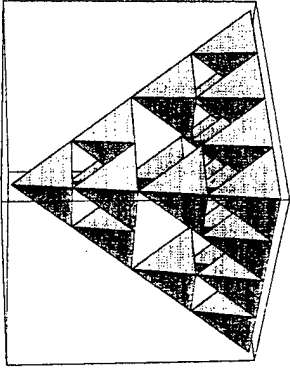
-Graphics3D-

```
Show[Graphics3D[
{Polygon[{{1/4,0,0},{0,0,0},{1/8,1/8,1/4}}],
Polygon[{{1/4,0,0},{1/4,1/4,0},{1/8,1/8,1/4}}],
Polygon[{{1/4,0,0},{1/4,1/4,0},{1/8,1/8,1/4}}],
Polygon[{{0,0,0},{0,1/4,0},{1/8,1/8,1/4}}],
Polygon[{{1/4,0,0},{1/2,0,0},{3/8,1/8,1/4}}],
Polygon[{{1/2,0,0},{1/2,1/4,0},{3/8,1/8,1/4}}],
Polygon[{{1/4,1/4,0},{1/2,1/4,0},{3/8,1/8,1/4}}],
Polygon[{{1/4,0,0},{1/4,1/4,0},{3/8,1/8,1/4}}],
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Polygon[{{1/2,1/4,0},{3/4,1/4,0},{5/8,1/8,1/4}}],
Polygon[{{1/2,0,0},{1/2,1/4,0},{5/8,1/8,1/4}}],
Polygon[{{3/4,0,0},{1,0,0},{7/8,1/8,1/4}}],
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Polygon[{{0,1/2,0},{1/4,1/4,0},{1/8,3/8,1/4}}],
Polygon[{{1/4,1/4,0},{1/2,1/4,0},{1/8,3/8,1/4}}],
Polygon[{{1/2,1/2,0},{1/2,1/4,0},{3/8,3/8,1/4}}],
Polygon[{{1/4,1/2,0},{1/2,1/4,0},{3/8,3/8,1/4}}],
Polygon[{{1/2,1/2,0},{3/4,1/4,0},{5/8,3/8,1/4}}],
Polygon[{{1/2,1/2,0},{3/4,1/2,0},{5/8,3/8,1/4}}],
Polygon[{{1/2,1/2,0},{1,1/4,0},{7/8,3/8,1/4}}],
Polygon[{{3/4,1/2,0},{1,1/2,0},{7/8,3/8,1/4}}],
Polygon[{{3/4,1/4,0},{3/4,1/2,0},{7/8,3/8,1/4}}],
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Polygon[{{1/4,1/2,0},{1/4,3/4,0},{3/8,5/8,1/4}}],
Polygon[{{1/2,1/2,0},{3/4,1/2,0},{5/8,5/8,1/4}}],
Polygon[{{1/4,1/2,0},{3/4,1/2,0},{5/8,5/8,1/4}}],
Polygon[{{1/2,1/2,0},{1,1/2,0},{7/8,5/8,1/4}}],
Polygon[{{1,1/2,0},{1,3/4,0},{7/8,5/8,1/4}}],
Polygon[{{3/4,3/4,0},{1,3/4,0},{7/8,5/8,1/4}}],
}
```

```
Polygon[{{1/4,1/2,0},{3/4,3/4,0},{7/8,5/8,1/4}}],
{Polygon[{{0,3/4,0},{1/4,3/4,0},{1/8,7/8,1/4}}],
Polygon[{{1/4,3/4,0},{1/4,1,0},{1/8,7/8,1/4}}],
Polygon[{{0,1,0},{1/4,1,0},{1/8,7/8,1/4}}],
Polygon[{{0,3/4,0},{0,1,0},{1/8,7/8,1/4}}],
Polygon[{{1/4,3/4,0},{1/2,3/4,0},{3/8,7/8,1/4}}],
Polygon[{{1/4,1,0},{1/2,1,0},{3/8,7/8,1/4}}],
Polygon[{{1/4,3/4,0},{1/4,1,0},{3/8,7/8,1/4}}],
Polygon[{{1/2,3/4,0},{3/4,3/4,0},{5/8,7/8,1/4}}],
Polygon[{{1/2,1,0},{3/4,1,0},{5/8,7/8,1/4}}],
Polygon[{{1/2,3/4,0},{1/2,1,0},{5/8,7/8,1/4}}],
Polygon[{{3/4,3/4,0},{1,3/4,0},{7/8,7/8,1/4}}],
Polygon[{{1,3/4,0},{1,1,0},{7/8,7/8,1/4}}],
Polygon[{{3/4,1,0},{3/4,3/4,0},{7/8,7/8,1/4}}],
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Polygon[{{1/8,3/8,1/4},{3/8,3/8,1/4},{1/4,1/4,1/2}}],
Polygon[{{1/8,1/8,1/4},{1/8,3/8,1/4},{1/4,1/4,1/2}}],
Polygon[{{1/8,1/8,1/4},{7/8,1/8,1/4},{3/4,1/4,1/2}}],
Polygon[{{7/8,1/8,1/4},{7/8,3/8,1/4},{3/4,1/4,1/2}}],
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Polygon[{{5/8,1/8,1/4},{5/8,3/8,1/4},{3/4,1/4,1/2}}],
Polygon[{{1/8,5/8,1/4},{3/8,5/8,1/4},{1/4,3/4,1/2}}],
Polygon[{{3/8,5/8,1/4},{3/8,7/8,1/4},{1/4,3/4,1/2}}],
Polygon[{{1/8,7/8,1/4},{3/8,7/8,1/4},{1/4,3/4,1/2}}],
Polygon[{{1/8,5/8,1/4},{1/8,7/8,1/4},{1/4,3/4,1/2}}],
Polygon[{{5/8,5/8,1/4},{7/8,5/8,1/4},{3/4,3/4,1/2}}],
Polygon[{{5/8,3/8,1/4},{7/8,3/8,1/4},{3/4,3/4,1/2}}],
Polygon[{{1/4,1/4,1/2},{1/2,1/4,1/2},{3/8,3/8,3/4}}],
Polygon[{{1/4,1/2,1/2},{1/2,1/2,1/2},{3/8,3/8,3/4}}],
Polygon[{{1/4,1/2,1/2},{1/2,1/2,1/2},{3/8,5/8,3/4}}],
Polygon[{{1/4,1/2,1/2},{1/2,1/2,1/2},{5/8,3/8,3/4}}],
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Polygon[{{1/2,1/2,1/2},{3/4,1/2,1/2},{5/8,5/8,3/4}}],
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Polygon[{{1/2,1/2,1/2},{3/4,1/2,1/2},{5/8,5/8,3/4}}],
}
```

Frustum

```
Polygon[{{1/2,1/2,1/2},{1/2,3/4,1/2},{5/8,5/8,3/4}}],  
{Polygon[{{3/8,3/8,3/4},{5/8,3/8,3/4},{1/2,1/2,1}}],  
Polygon[{{5/8,5/8,3/4},{5/8,3/8,3/4},{1/2,1/2,1}}],  
Polygon[{{3/8,5/8,3/4},{5/8,5/8,3/4},{1/2,1/2,1}}],  
Polygon[{{3/8,3/8,3/4},{3/8,5/8,3/4},{1/2,1/2,1}}]}],  
ViewPoint->{3.950,-3.355,0.398}]
```



-Graphics3D-

HTML/JAVA

**HTML/JAVA Team
Final Report
August 2, 1996**

Courtney Fields
Makeba Fussell
Kuchumbi Hayden
Reginald Turner
Kimberly Wright

Michelle Brown, Graduate Student
Marie Dail, Graduate Student
Tracy Chamberlain, Mentor

Outline

- ♦ HTML Techniques
 - Tables
 - Frames
 - Animated Gifs

- ♦ ECSU Homepage

Tables

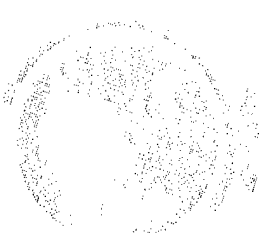
- ✦ Before tags for tables were finalized it was necessary to use the `<pre>` tag for tabular information.
- ✦ Tables are very useful for the presentation of tabular information.
- ✦ They are also excellent means of presenting regular information for creative HTML authors.



Table Elements

The general format of a table looks like this:

```
<TABLE> - start of table definition
<CAPTION> caption contents </CAPTION> - caption definition
<TR> - start of first row definition
<TB> cell contents </TB> - first cell in row 1 (a head)
<TB> cell contents </TB> - last cell in row 1 (a head)
</TR> - end of first row definition
<TR> - start of second row definition
<TB> cell contents </TB> - first cell in row 2
<TB> cell contents </TB> - last cell in row 2
</TR> - end of second row definition
<TR> - start of last row definition
<TB> cell contents </TB> - first cell in last row
<TB> cell contents </TB> - last cell in last row
</TR> - end of last row definition
</TABLE> - end of table definition
```



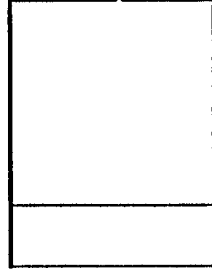
Frames

- ★ Divide web pages into multiple, scrollable regions.
- ★ Each frame has several features
 - an individual URL
 - given a NAME
 - resize if the user changes the window's size.
- ★ Elements that the user should always see can be placed in a static individual frame.



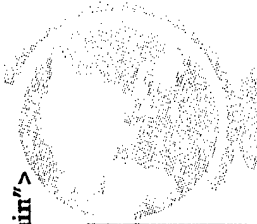
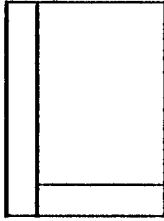
Frames Syntax

```
<frameset cols="30%,70%">  
<framesrc="contents.html">  
<framesrc="linkone.html" name="MAIN">  
</frameset>
```



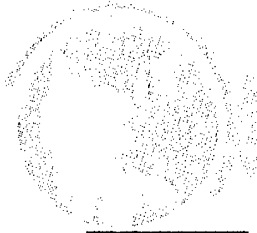
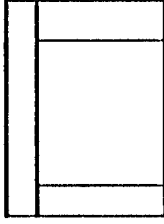
Frames - Examples

```
<frameset rows="25%,*" >  
<framesrc="linktwo.html" name="banner" scrolling="yes" >  
<frameset cols="30%,70%" >  
<frame src="contents.html" >  
<frame src="linkthree.html" name="main" >  
</frameset >  
</frameset >
```



Frames - Examples

```
<frameset rows="25%,*" >  
<framesrc="linkone.html" name="banner" >  
<frameset cols="25%,50%,25%" >  
<frame src="jordandunk.html" >  
<frame src="shaqdunk3.jpg" >  
<frame src="kempdunk.jpg" >  
</frameset >  
</frameset >
```



Animated GIFS

- ✦ Animated GIFS are called GIF89a images.
- ✦ Most GIFs over the years have only one image per file.
- ✦ Most programs that work with GIF are designed around the idea of one image per file.



Animated GIFS

- ✦ GIF89a allows multiple images to be compiled within a single GIF file.
- ✦ Single GIF file you reference in your HTML pages will display multiple images, in sequence, just like flip-book animation.



Creating Animated GIFS

Nine steps to animation using GifBuilder for Macs:

- Pick the image that you wish to animate.
- Make the image rotate in the style you wish the animation to appear. (Hint: alphabetically title each picture.)
- Put images on the desktop.
- Using GifBuilder insert images into frames.
- Arrange images correctly.
- Make your specifications.
- Click on Run icon and select start to view your progress.
- Copy animated image to the correct directory.
- Place the image into the html document using normal html formats.

Animated GIFS

- ★ GIF animations are showing up everywhere.
- ★ Animated GIFS are created by individuals in their spare time and are free.
- ★ Everyone is finding merit in their implementation and fun in their use.



Student Life



Athletics

Administrative

Alumni, Development & Planning



About ECSU



Admissions Information



Academics & Research



Libraries





- Introduction
- History of the University of North Carolina
 - ECSU Mission
 - Campus Map
- Degrees Available
- News
- Directory

Elizabeth City State University



Dismal Swamp Boardwalk Project

Development and Purpose

The Dismal Swamp Boardwalk Project was completed and dedicated by Elizabeth City State University in the Spring of 1994. The wetlands property, consisting of 639 acres, was acquired by the University from the Department of Health, Education and Welfare. The half-mile long boardwalk and observation tower were constructed with Title III funds, and its primary function is to provide access to a wetlands wilderness area for use in research and educational activities.



Elizabeth City State University



Department of

Mathematics & Computer Science

- NASA-NRTS at ECSU-(Regional Training Site)
- ONR Nurturing ECSU Research Talent-(NERT) Program
- CS Student Homepages

Scholarship Opportunities

- ECSU- ONR Scholarship Program

- NASA Regional Network and Training Center Scholarship Program

NASA-NRTS Service Award Winners



U N D E R C O N S E R V A T I O N



Welcome to the

Nurturing ECSU Research Talent-(NERT) Program

Funded by the Office of Naval Research

The Office of Naval Research (ONR) coordinates, executes, and promotes the science and technology programs of the United States Navy and Marine Corps through universities, government laboratories, and nonprofit organizations. It provides technical advice to the Chief of Naval Operations and the Secretary of the Navy, works with industry to improve technology manufacturing processes while reducing fleet costs, and fosters continuing academic interest in naval relevant science from the high school through post-doctoral levels.

Research Teams

- Multimedia Authoring
- Fractals and Chaos
- Computer Graphics
- Unix System Administration
- Mott Scattering
- Statistical Analysis
- Numerical Analysis

Summer '95 Research Project

Conference Reports



Elizabeth City State University



Music Department



Music Industry Studies

Within the Music Industry Studies Degree Program, concentrations are offered in Music Business Administration and Music Engineering & Technology.

The Music Business Administration concentration focuses on music business, management, marketing, sales, publishing, retailing, and promotion. The Music Engineering & Technology concentration is based on state-of-the-art, 24-track recording and MIDI/electronic music studios. The curriculum incorporates studies in audio, MIDI, and computer applications.

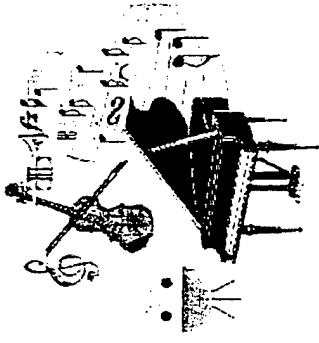
The Music Industry Studies Degree Program provides students with the opportunity to record, produce, and market actual products through the student operated record label, music publishing, and music production companies.

DEGREES OFFERED

Bachelor of Science in Music Industry Studies
Bachelor of Arts in Music

CONCENTRATIONS

Music Engineering & Technology
Music Business Administration
Voice Theory & Composition
Piano & Organ
Brass
Woodwinds
Percussion



PERFORMING GROUPS

1. Concert Band
2. Marching Band
- Collegians Jazz Ensemble
3. Brass Ensemble
4. Woodwind Ensemble
5. Percussion Ensemble
6. University Choir
7. Choral Ensemble
8. Vocal Jazz Ensemble
9. Gospel Choir
10. Collegium Musicum



To return to the ECSU homepage, [click here](#)

Publishing on the World Wide Web: Organization and Design

By Patricia J. Lynch

Patricia J. Lynch, Director of Yale University's Center for Advanced Instructional Media, Web, as well as the creation of an effective interface to electronically published materials via well designed Web pages.

Every graphic designer or editor who has ever delivered the final manuscript of a document to a printer knows a very special kind of fear: It's the fear that you are just about to pay someone a great deal of money to produce 10,000 copies of some nice, nice, you made, not didn't, catch, despite all your proofreading, publishing is not for the feeble or faint of heart, especially in academic organizations where disseminating information is at the heart of the enterprise. The logistics and expense of moving information from your desk to a wide audience are always formidable when paper is involved, and few organizations have more information-related expenses per employee than colleges and universities.

For years now we've been hearing about the advantages of electronic publishing over plain networks, where just one copy of a document exists and everyone can access it via the network. The logic is compelling: Find a typo? You have to update a phone number? All "wired" and everyone on the network now has a new "copy" to read. Instead of dead information emblazoned on paper, we'll have live, up-to-the-minute information, instantly available. But the rhetoric of electronic publishing has rarely matched the reality, and between technical networking

handaches, awkward authoring tools, and cross-platform incompatibilities, the progress of networked electronic publishing just stumbled along—until about a year ago.

Beyond Print, but Not Quite Paperless

If you have been paying attention to the computer press lately you have probably heard about the World Wide Web (WWW) and graphical Internet browsers like NCSA's Mosaic and Netscape Corporation's Netscape Navigator. If you've somehow missed all the fuss over the Internet's first "killer app," see Ralph Abraham's introduction to the WWW in February's issue of *Syllabus*. Publishing text, pictures, sound, and even video clips over the Internet has never been easier, and the number of Web users roaming the Internet is astounding. At Yale's Center for Advanced Instructional Media, we put up a WWW site in mid-January of this year (<http://info.med.yale.edu/eam/>).

C. HOME (HTML). By mid-February the site had been "hit" by individual WWW users almost 400 times, and that was before we even had a chance to publicize it in the usual WWW indexes and catalogs. The *New York Times* recently quoted an estimate that within a year from now, up to half of all Internet traffic may be related to

World Wide Web documents. Current estimates of WWW users range up to 20 million, and with the recent linking of Prodigy, CompuServe, and America Online to the WWW, the number of potential new users continues to grow rapidly. Today there are few more cost-effective ways to disseminate information than through WWW documents delivered over the Internet.

Before you brace yourself for another starry-eyed paean to the "paperless office of the future," let me admit that most academics working today will probably print anything they're really interested in from the Web, and file it away with the rest of their reports. Paper is comforting, and familiar, and those of us who have grown up depending on it are loathe to give it up even when we fully understand the advantages of on-line documents. But I suspect that the next generation of academics will be much less attached to paper, and more dependent on (and more demanding of) electronic documents and information networks. Paper will never completely go away, but the trend lines for growth in paper publications will flatten over the next decade as more and more reference information goes digital. The economics of publishing make this inevitable, and academic publications and reference works will lead the way.

Don't believe me? Look what has happened to encyclopedias: sales of the digital CD-ROM versions have surpassed paper versions this year, and at the current rate, there may not be any paper encyclopedias in production two years from now (collectors take note). The cost advantages of Internet publishing or publishing on CD-ROM are so great that the capital-starved, price-sensitive world of academic books and professional journal publishing will become primarily digital and networked long before the mainstream publishers to digital formats.

Educational Web Publishing: Not Just Another Pretty Interface

The implications of WWW electronic publishing by educational institutions









fall into two interrelated information management categories: the transmission of information to faculty, staff, and students within the organization (the internal agenda); and what is included for the rest of the world, including academic colleagues, prospective students, alumni, and prospective donors (the external agenda). Addressing both agendas will probably require some fundamental changes in your school's administrative and academic information management policies, starting with a realization that your school's WWW pages and any other Internet-accessible information you have posted will already be one of the most widely read and influential views of the world from your campus and institutional behavior. Is anyone on your campus asking just what your WWW pages are saying about your university?

The WWW is so new and has grown so fast that most universities have not had a chance to review and make formal policy decisions with respect to how their information is posted in WWW pages, what editorial and design standards should be used, and how to better coordinate and link all the bits and pieces of information that are already posted on their university file servers. Most of the WWW activity in universities has grown informally over the last year, mostly as a result of the grass-roots efforts of individual faculty, staff, and students. Can most campuses this has resulted in a heterogeneous mix of styles, messages, and quality levels that are haphazardly linked together into campus WWW "home pages." Without an organized effort aimed at harnessing the power and capabilities of the WWW, much of the potential usefulness of the medium will be lost in a chaotic tangle that is neither easy to use, nor stable enough to depend on for important academic and administrative information. The challenge is to begin to coordinate and harmonize the "look and feel" of your university's Internet presence without quashing the creativity and enthusiasm that makes the WWW such an interesting vehicle for information publishing

The first task is to recognize that your university needs a consistent, coordinated approach to the electronic publishing of information. The next task is to define what you want to say, you will organize those efforts to present the same professional, high-quality standards of content and production values you would insist on for any printed communication from your university. Carefully designed WWW pages are not just a matter of setting the right stylistic "tone" in your internal and external communications. Properly designed WWW sites, with coordinated graphic design, high editorial standards, and consistent user interface conventions, are the only way WWW information publishing will pay off by successfully convincing your various audiences that your WWW publications are the quickest, easiest, and most reliable places to find university information. **■**

The Legi-Slate Gopher Service Your Window to the World of Government Information

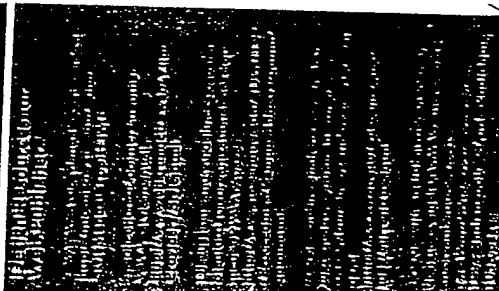
Only the Legi-Slate Gopher Service

-  Provides timely, comprehensive information about all bills in Congress and federal regulations using the Gopher protocol.
-  Adds value to your network by providing access to the same quality information relied upon by Congress and industry.
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-  Lets you search for bills using Legi-Slate's exclusive subject indexing and "Hot Bills" directory.
-  Provides the most detailed legislative histories of bills available from any commercial or government source.
-  Points you to related government documents and news articles.
-  Provides faculty with a valuable Congressional and regulatory research tool.
-  Costs only pennies per year per student!

FREE

Provides limited free public access. Point your gopher or WWW browser to gopher.legislate.com (port 70).

For further information, please contact Ann Harris (ah@legislate.com) LEGI-SLATE™, 701 Rock Creek Road, Washington, DC 20007-2907, (202) 638-1111



Currently, links can only be added by the author of a document. A different model of hypertext separates document and links, so a single document can feature different sets of links, and links can be updated without touching the document itself. This also allows annotations to be added by readers. Annotations were an original experimental feature of WWW that seem to have disappeared but I must mention them because they are kinds of links. Because the content of the same URL often changes, the content of a URL can refer to several documents, as discussed earlier. It is also difficult to come up with a reliable, persistent annotation mechanism.

Within the Internet, HTML is already replacing a number of similar text systems, such as multipurpose Internet mail extensions (MIME) rich text [15] or mail manual pages. While these have been extensions of SGML, in the presence of a client-side user interface, they appear overly complex but still offer the full programming flexibility of a text editor. In fact, hypertext solutions, particularly those that have widely deployed authoring tools, seem to be diminishing this application.

URLs and URNs

Universal resource locator is just one of the names used to designate objects within the World Wide Web. The whole family is technically known as universal resource identifiers, of which URLs name the physical location of an object [16, 17]. Universal resource names (URNs) identify without regard to location, and uniform resource identifiers (URIs) describe properties of the object. Only URNs are in widespread use. They consist of an identifier for the present (http, ftp, etc.), the network location (host and port), and a path name within the named server. While the path is typically mapped directly onto a file name by the server, this is purely a server convenience. A server could just as well use this path as a key into a database or as a function name and arguments in a dynamically generated document.

Note that a URL says nothing about the type of object to which it points, even though most URLs give some informal hints to the initiated. An example of a URL is <http://www.w3.org>. Most home-page URLs pass the "business card test," the failure of which disqualifies a URL as a home page. The failure of which disqualifies a URL as a home page is to be accessed via HTTP. Despite its apparent hierarchical nature, the domain name space (DNS) is particularly flat because a large majority of names are drawn from the .com domain. Even countries as large as Germany have a flat second-level domain name. Since registration costs only about \$50 a year, companies have taken to registering every one of their products as a domain name. This is relatively harmless, but causes inevitable clashes since the Internet domain name space lacks the distinction of type of trade, country, and region that allows reuse of popular names in the area of traditional trademarks. Thus, the regional naming structure found in the .us domain will have to become the common case rather than the exception.

Letting a URL name a single host has a number of disadvantages. If that host crashes or is overwhelmed, the retrieval

fails. Large sites have found a number of work-arounds like DNS aliases or distributing different name information in different subsidiary name servers.

In a better system, the domain name service used to translate Internet host names into IP network addresses would offer a per-domain service listing, extending that used for e-mail today. Most registrations have a one-of-a-kind email address responsible for that domain. A mail transport agent goes down the list until it finds a working remote host. A similar system could be introduced for WWW service. There are also currently proposals to include a host's geographical location in its DNS record.

Given a list of aliases, equivalent servers and their geographical location, browsers could look locally first before sending a request across the ocean.

URLs were once considered to be temporary artifacts until a more powerful naming mechanism could be deployed. However, URNs seem to be emerging, the name temporarily as e-mail addresses, also long considered to be replacement with lookups by name in a global X.500 directory. The basic idea has permanent names, URNs, and the basic idea is to describe their properties and URIs, including their current location. However, somebody has to maintain and pay for this directory. The name URIs that change frequently are also likely to be the ones that the maintainer forgets to update in the directory since she has lost access to or interest in the content. Finding documents would only be made easier if the number of registers is relatively small and if authors of documents, including all the mixed-media instruments, VML (VRML), and the like, can agree on a common set of meta data and scientific notations, the addresses of individual documents within their literature are not very likely to change. Thus, if ephemeral URLs, additional lookup delay or decreased stability, to avoid "stale" links. For some forms of documents, particularly universally technical reports and scientific publications, an electronic directory seems appropriate and likely to take shape, since the organizational infrastructure and incentive are largely in place. Also, it would indeed be very useful to have a "repository of last resort" for digital artifacts, the equivalent of the U.S. Library of Congress.

Browsers

One of the factors driving the success of the WWW is its ability to both attract content providers and serve as a base for new applications. While in the past a corporate library may have written its own user interface to its library catalog, it now appears much easier to have this run a Web server and browser. This avoids having to write a new user interface for each new client platform or operating system, and automatically lets the system participate in advances like security.

There seem to be two contradictory directions for WWW applications: the browser that can do everything and handle every application has WWW capabilities. The latter makes it

¹ This assumes that geographical distance is equal to network distance. However, the Internet network distance between two European cities is often through Washington, D.C.

difficult to integrate several data types, but it is certainly desirable to have applications recognize URLs and control a browser to view the URL content. Browsers are already incorporating mail links, news readers, and very primitive file system managers, and they will also feature text editors, at least for HTML. While this integration has the advantage of hiding the difference between local and remote operations in a large extent, it also leads to large applications and less choice of vendors. Other mechanisms to integrate different applications are currently being explored, for example, so-called plug-ins. These applications communicate directly with the browser and share some of its window area.

Network Ingress and Requirements

Since the Internet has gone commercial, it is difficult to ascertain exactly what face-ITIP or wide-area traffic is generated by WWW browsers and how that the total traffic. WWW stresses the Internet in that browsing has low latency requirements, as a human is waiting impatiently. The data transfers can be anything from a short burst for a small image to several tens of megabytes for a video or audio clip. While text and images on a single page usually come from the same host, hyperlinks traversed have no real spatial correlation. The low spatial correlation will strain any IP-over-asynchronous transfer mode (ATM) mechanism that attempts to set up individual switched virtual circuits for each Web request.

In any of the above, input in high bandwidth services, the WWW can only scale if information content is mirrored and cached. A mirror provides a complete copy of some server, with the master server explicitly updating its mirrored copies. Mirrors are trusted, at least to some extent, by the data source. Mirrors can be configured by manual selection or, possibly, through a domain name service mechanism. If URN directories ever come into widespread use, these could obviously also return several candidate locations for a document. A busy server could also send a redirect answer to a browser, but it had better be sure that the server to which it is redirecting exists is not busy or down.

Caches are placed between client and WWW server (e.g., on the premises of a company or a university) and have a direct trust relationship with the server. Typically, the browser is directly enlightened with the location of a single cache server, which takes any comment to other caches. The client connects to the cache and requests the document, which the cache server either has stored already or in turn retrieves from the original server, keeping a copy to satisfy future queries. Caches can be quite effective [6], but can also easily become bottlenecks and then be avoided by users. Also, many documents that look static are actually generated anew for each request, and thus are not cacheable. Since many servers want to keep a running log count for their offerings, they actively defeat caching by setting expiration dates as immediate or otherwise, making information as noncacheable. Thus, some information must be found to enable caches while providing accurate access counts to the main server. Also, documents with access authorization currently cannot be cached; in the future, this may be a large fraction of popular documents.



If a hierarchy of caches is to be built, there has to be a routing mechanism that determines which caches should be queried for a document. For that, a client may need to know the actual location of the document so it can avoid contacting a cache where the actual location of the document is closer. It remains to be proved, however, which can be gained with multiple cache levels, since there is probably a stronger affinity of interest on the level of a company or department than a whole country.

Limitations of the WWW Model

Despite all the press and publicity, the WWW model is currently rather limited and under development. It is likely that future browsers will ease to display-only and allow editing and storing back documents, at least those written in plain ASCII or HTML. This would make them more competitive with other asynchronous computer-supported cooperative work environments.

Client-side interaction is currently limited to filling out simple forms and clicking on buttons and hotspots (so-called hotlinks). There are some efforts to provide more direct feedback to the user than having to fill out the whole form a bit by bit, but this field is wrong or clicking on parts of a button without any feedback as to what, if anything, might happen. Client-side image maps store the coordinates of sensitive areas so the browser can provide local feedback. Client-side scripts or applets would allow the provision of interactive help or correctness checks, as well as possibly richer user interfaces so the content of a page can adapt to user action rather than simply reloading a page from the server.

The integration of multimedia is currently very primitive. A video or audio file is transferred via HTTP, and then played with sufficient buffering or from local temporary storage. Playing audio and video as it arrives from the network avoids waiting until it is downloaded completely (only in slow-motion bandwidth is not worth the wait). However, unless the minimum network bandwidth is the access bandwidth, assumed known, the user has no way to choose an appropriate encoding or to be buffered to ensure playback without interruptions. A number of solutions can be envisioned. First, non-TCP protocols such as Real-Time Transfer Protocol (RTTP) [18] that provide congestion feedback can be used to adaptively tune their buffering and encoding to the available bit rate. In addition, for both TCP and other protocols, resource reservation could guarantee a minimum bandwidth [19]. Adaptive applications require no changes to the Internet, but are still subject to glitches when adapting quality down-

² Internet are networks within organizations that may or may not be connected to the Internet, but use some of the same technology and protocols.

ATM Networks

**AASERT 1996 Summer Research Program
ATM NETWORKING TEAM FINAL REPORT**

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This summer the ATM Networking group discussed some theoretical concepts of ATM and the ATLAS program. The team also focused on other topics such as networking faculty offices, becoming familiar with UNIX commands and file system, and reviewing two articles on current technology taking place throughout the nation.

1. ATM

The concepts of ATM that were discussed were its architectural/ transmission views, its connectivity, and the cell itself. The three architectural/ transmission views compared and discussed were packet switching, frame relay, and cell relay.

Packet switching is a method of transmitting data messages through a communications network, in which large data is broken into smaller packets. Data is transported across a medium in packets. These packets are then transformed into frames, where they are converted to packets. Once reaching their destination, the packets are changed back to frames, then to packets. (See Diagram 1) Packet switching transmits data on a "first come, first serve" basis making the transfer time vary.

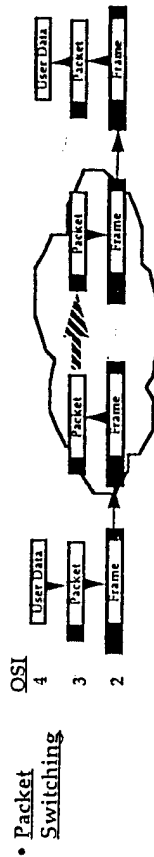


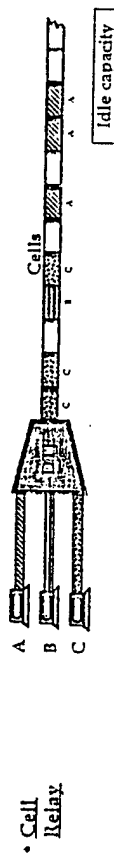
Diagram 1

Frame relay is an updated type of communication network from packet switching. Data is transported in frames as opposed to packets and is transported quicker to its destination. When errors are found the frames are discarded and the user must retransmit data. Frame relay is somewhat similar to packet switching because both transmits data on a "first come, first serve" basis and the amount of time it takes to transfer information varies.



• Packet Switching
& Frame Relay

Cell relay, an improvement of frame relay, is the most commonly used transmission for ATM. Information is broken down into fixed "cells" of 48 bytes that can be easily transported without a high risk of losing data. It also transmits data on a "first come, first serve" basis, but transmission time is quicker because of the fixed length cells. Cell relay has a priority scheme which allows some data to have higher transmission priority. In most cases, video and audio carries a higher transmission priority than data.



• Cell Relay

The next part of ATM discussed was connectivity. Connectivity is made up of three parts: physical link, virtual path(VP), and virtual channel(VC). The virtual path describes a set of virtual channels that are grouped together between cross points. Virtual channel describes the flow direction of ATM cells between connecting points that share a common identifier number. The VP and VC is the route that the data is transported from point to point.

The ATM cell is 53 bytes long consisting of two major parts, a header and the payload. Each cell has a 5-byte header that identifies the cell's route through the network. It also has a 48-byte payload of user information as well as service adaptation functions. This user data in turn carries any headers or trailers required by higher level protocols. (See Diagram 2)

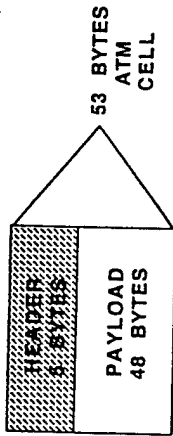


Diagram 2

In preparation for bringing ATM and Ethernet to the desktop in Lester Hall, the following was done. The communication closet in Lester Hall was set up as such, 5 hubs were installed given us 120 ports available for Ethernet to the desktop. In order to link the hubs, we had to install two types of EPIM cards, EPIM-T (twisted pair) and EPIM-F2 (fiber optic) into the hubs. We used a cable of 15 pairs of fiber that were pulled from Doles Hall to Lester Hall's communication closet into the Fiber Distribution Center (FDC). A fiber optic patch cable is connecting the very first hub from the FDC. Also, there was a twisted pair patch cable attached from hub to hub to give connectivity. Next, we had to make twisted pair jumpers to go to the patch panel from the hubs.

The FDC distributes the fiber to its destination. From the FDC, the patch cable goes to the ATM switch. The purpose of the switch is to convert data to ATM speed. A patch cable is then connected from the ATM switch to the Ethernet switch, which sends data through Ethernet line versus fiber optic. Finally, the ethernet switch is connected to the rack of hubs already installed. At the present time, data is being sent via ethernet to the desktop. (See Diagram 1 in Appendix A) Future plans to get ATM to the desktop is to add a patch panel in the communication closet and another in the lab. These patch panels will be connected with fiber.

II. ATLAS

ATLAS is an acronym for Affordable Technology to Link America's Schools. The main objective of the ATLAS program is to enhance the economic competitiveness of tomorrow. This project is designed to allow K-12 schools the opportunity to have internet access. There are four key entities in the implementation of the ATLAS program. They are NASA, state governments, national institutions, and industries. NASA center's role will be to obtain state

government buy-in, offer partnership roles to the State Department of Education, commercial sponsors, etc. The state government will address the need for ATLAS to be implemented across the state and also to identify universities, governor schools, and other organizations which could serve as Internet Central Sites. The industry's role is to identify the functions of ATLAS technology and provide a demonstration of how it can be supported and maintained by their company.

The architectural design of ATLAS is to have a server, within the K-12 schools. This server will serve as an internet host for that school. It will have a modem attached that will allow the school to have dial in access to the host site. The server at that host site is then connected to the Internet. K-12 schools get their access via a host site. These connections can be seen in Appendix B. Diagram B-1 shows the Local Area Network (LAN) within the K-12 schools. Diagram B-2 shows the Wide Area Network (WAN) using the host site as the internet provider.

The advantage of ATLAS is its use of caching. The server in the elementary and secondary school has an external harddrive for caching connected to it. An example of cache is the storage of data to be used at a later time. The advantage of the caching system is the control it gives the school over data being broadcasted in and over the school. It allows the students to retrieve information and store it on the external harddrive. This information can later be used by other students which keeps the use of the modem line down to a minimum.

The government funds the ATLAS program, however they only fund the research on an assessment of what a school has and what will be needed to run the ATLAS program at that school. The elementary and secondary schools pays for all the equipment and of the training. NASA and host sites pay for the remainder of the training.

The team visited three K-12 in Portsmouth, Va. (Emily Spong Elementary, Douglas Park Elementary, and I.C. Norcom High School) that are a part of the recently funded grant from NASA. The purpose of the visits were to see how they could take advantage of the ATLAS program. The visits consisted of notating and documenting their current electrical outlets, computer types, and other things in their computer labs. The purpose was to inform the schools them on how their labs should be setup. It also included the types of hardware and software needed in order to run certain applications such as Netscape. (Diagrams of each school can be found in Appendix C.)

After an assessment of Emily N. Spong Elementary School's technology, the following conclusions have been made. The library has been selected to serve as their computer resource lab. The lab consists of ten Macintosh LC II's, a 6100/66 Power Macintosh, and an ImageWriter II printer. The Macintosh LC II's currently have two expansion slot cards with one

slot being used for 5.25 external floppy drive. The LC's can be upgraded to meet the standard of ATLAS by adding disk space, RAM, and Ethernet card for networking purposes. A total of four lines is suggested to connect the ATLAS server.

At Douglas Parks, there are a few key factors that were needed to be noted. First, we decided that the phone line in the Library would more than likely be the line connected to the ATLAS server. There are currently 28 macs being considered for the ATLAS program; 22 LCII's, 4 LC 575's, and 2 mac laptops on order. It was recommended that the lab hold at least 15 computers to comply with the average 30 students per class. This makes access to the computers easier by assigning two students per machine. The remaining computers will be distributed throughout the other classrooms, utilizing one as a teacher workstation. There is also the possibility of setting up floating machines on cart to allow portability.

After assessing I.C. Norcom High School's technology, these conclusions have been made. Currently, there are two options as to where the ATLAS server can be placed. It can be put in the library (room 211), located on the 2nd floor, or the computer lab (room 108), located on the first floor.

In the lab there are 15 computers; 1 IIVx, 11 LCII's, 1 Quadra 800, and 2 LC's. All the LCII's have a 440 harddrive, the LC's have a 240 harddrive, and the Quadra 800 and IIVx have 8megs of RAM and a 240 harddrive. Plans are being made to add five more computers to the computer lab.

Once all the assessments were made, a list of proposed items that are required in order for all the mentioned K-12 schools to have internet access was composed. The list consist of the following:

1. Minimum of 15 Macintosh systems
2. At least 16MB of RAM for each machine
3. Telebit Fast Blazer 28.8 Modem
4. SCSI External Drive (cache, 2.1 GB)
5. Hub and cables
6. Ethernet LAN Networking Card
7. Networking software (Network starter kit (optional))
8. Server, consisting of:
 - Sunsparc 4
 - 535 MB of internal Harddrive
 - 32 MB of RAM
 - Color Monitor
 - Internal CD-ROM Drive

- Internal Floppy Drive
- Multiport Magma Serial Card

9. Three phonelines for administrative staff and teacher use in addition with the phoneline to dial out to the server at the host site.

III. Networking Faculty Office

Networking the faculty offices is one of various tasks to be completed for this summer in order to give professors access to the internet from their offices. In order to set a PC up on the web, we had to install the Network Starter Kit Software. The directions for installing starter kit and netscape will follow:

Directions for running starter kit

1. Run ezstart (if not installed then install using disk)
(note the RAM address) to verify the x= line in #2

2. Modify config.sys
line 2 = c:\dos\emm386.exe noems x=CC00-CFFF
(may change according to machines address)

3. Edit autoexec.bat
Add the following lines at the bottom of the file:

```
cd \smcpcck
pack1
cd \
```

(if there is a window or menu in the autoexec.bat file then add the 3 lines before those lines)

4. Create directory called smcpcck
type command: (mkdir smcpcck)

5. To Copy information from driver disk to smcpcck directory:
type command:(xcopy *.* c:\ smcpcck)

6. Install starter kit
All instructions in starter kit book start on pg.7
section 1.3.1 then skip to Section 1.3.3

For network starter kit running TCP-MAN

1. Go to "File", Run, TCPMan under Winsock
2. Enter IP address

Netmask: 255.255.255.0
Name Server: 152.4.20.3
Default Gateway: 198.85.48.254
Domain Suffix: ecalu.edu
Packet Vector 7e

3. Exit
4. Go to File, New, Program Group and title it Network Starter Item
5. click on main, then windows setup
6. Options, Setup applications, search for applications, c: local drive
7. Select following files and select them by pressing the spacebar:

```
D shell
autor 144
FTP LPO Utility
FTP LPR Utility
FTP RSH Utility
ftpw.EXE
hopchkw.EXE
MOSAC
pingw.EXE
tcpman.EXE
lshw.EXE
trmpitel.EXE
view.EXE
winarch.EXE
```

8. Click o.k. continuously until set-up is complete
9. Copy tcpman.exe into the startup folder

Installing Netscape 2.0 (optional)

1. Go to Program Manager and select Main, put disk in
2. Change to a: or b: drive
3. Title screen under Windows menu
4. Go to root directory and create a directory called netscape
5. Open the directory
6. Copy files from a: or b: drive to the netscape directory by holding the shift-key and use arrow keys to select files
7. Redo no. 6 for disk 2
8. Double click on setup.exe in netscape directory
9. During setup keep clicking next until it stops loading

10. After the setup is completed, return to the Program Manager

Aside from networking, the team is also responsible for system administration tasks and duties therefore, being conscious of commands and file systems is a necessity. The two UNIX books we used were UNIX Tamed by Rodney Wilson and UNIX Systems by Douglas Troy. These books included questions and exercises demonstrating how to effectively use UNIX. Some of these activities gave us an introduction to UNIX and its file system. We reviewed articles "Campus Nets for the Nineties" by Raymond K. Neff, Ph.D. and "Technology Across the Campus" on the advances of technology and computer science.

IV. Articles Summaries

"Campus Nets for the Nineties"
by Raymond K. Neff, Ph.D.
Educom Review, Special Issue on Networking
March/April 1996

Case Western Reserve University (CWRU) is upgrading its campuswide networking system by moving from baseband to broadband. They also plan to use upgraded prototypes such as ATM (Asynchronous Transfer Mode) therefore, enhancing its network in terms of the usage of future applications. For example, multimedia data including voice, video and audio can be transmitted on its network.

CWRU has a perception of its campus network contents. First of all, there is a universal network for the campus therefore, everyone has access, utilizing it to its maximum potential. Communications services such as video, voice, multimedia data, and etc. will be supported by its network and the network is fast enough so there is never the problem bottlenecking. Another important aspect of its network is its wire-once architecture, this allows the network cabling to not be reinstalled because of different network topologies that may occur. Mostly, this is due to fiber-optic cabling being used with its longevity and the use single mode and multimode. Single mode is capable of using gigabit and terabit transmission rates while, multimode has can be used as in-building cabling. CWRU also has standards for its signaling and protocols for computer transmission rates which is mostly in part due to ATM and SONET (Synchronous Optical Network). They are ran on fiber-optic wiring being that has high scalability speed and ultrahigh-speed transmission.

The university plans to keep up with the changing technology by first going from baseband to broadband. Baseband technology, such as Ethernet, handle single communications channel on a single wire. A broadband technology uses a single wire to transmit multiple

channels of information. They also hope that ATM and possibly SONET will be the preferred transmission technology so that large quantities of data can be packetized. Multimedia applications will be transmitted at the appropriate time so that the problem of segmented or jerky will not exist. The library and classrooms of the future being accessed from a computer pose a big question for the campus network. Since, digital books and images, software libraries and journals are being added to libraries and videoconferencing being one example will help bring the classrooms to the student instead of vice versa show the importance of the campus network and how it will play a big role in the institution's future. By the end of this century, Case Western Reserve University plans to have a new utility infrastructure for communications technology and it also plans to extend beyond the university into the community.

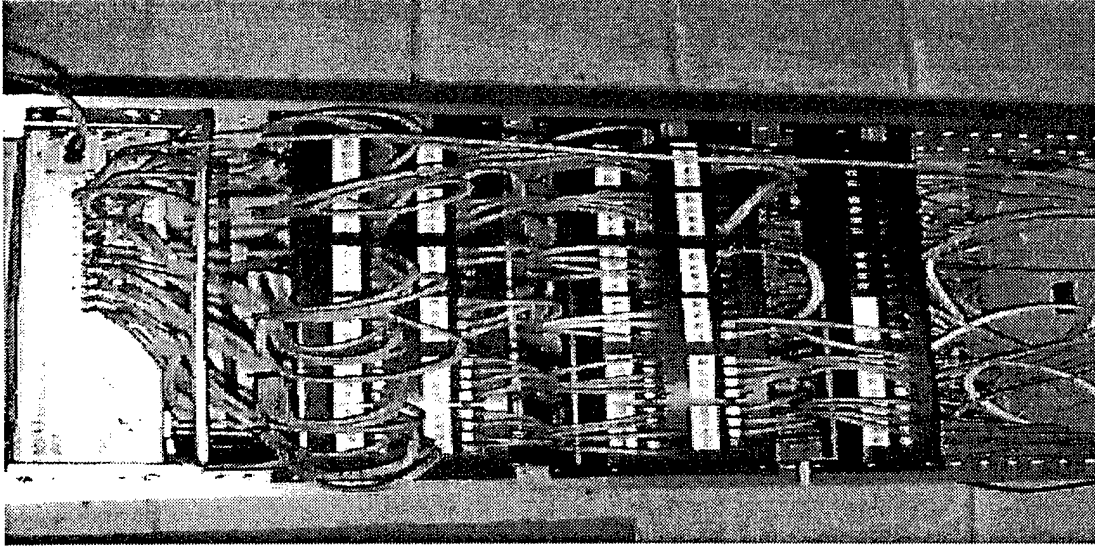
"Technology Across the Campus" Syllabus 1996

"Technology Across the Campus" discusses technology activities such as a virtual theater, video conferencing, distance learning via optic fiber, and full motion video occurring at four universities across the nation. The University of Kansas uses the virtual theater headed by Mark Reaney, Associate Professor of Theater and Film. He uses virtual reality software Virtus WalkThrough Pro to plan sets for plays. A video device is used to display the background and other images on a screen behind the actors which is monitored and controlled by an offstage computer operator. One aspect that adds to the plays is the use of 3D glasses that see converged dual images giving the illusion of 3D space.

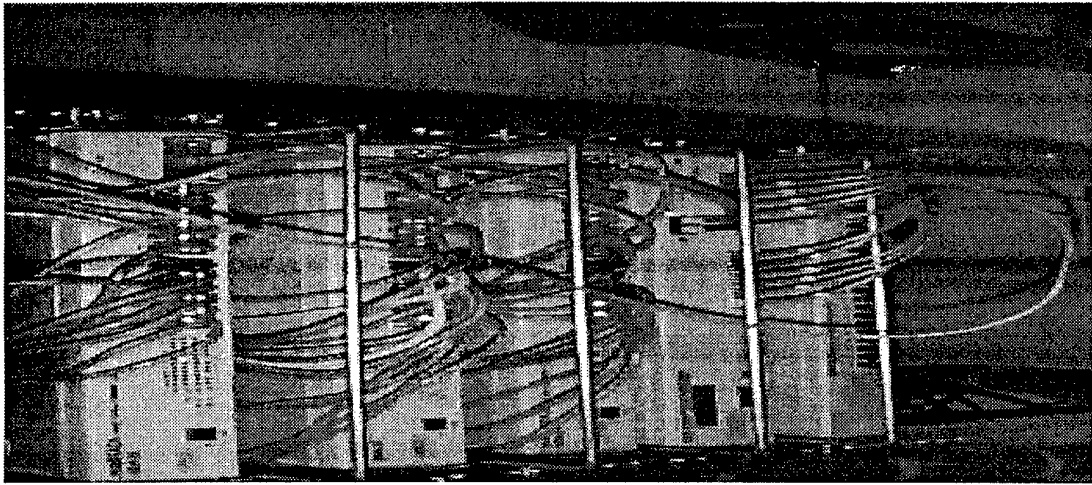
At WSU (Washington State University) video conferencing is used provided to people across the state. In 1985, a program called Washington Higher Education Telecommunications Systems (WHETS) to allow students to take classes held at other locations. This is serviced by VideoServer's Multimedia Conference Servers (MCS) due to its multipoint capabilities. Its network is connect through a microwave LAN-based network. WHETS is proving to be effective because ten years ago only ten students were enrolled now 77 classes with 2,300 students are apart of the program. WSU allows the video conferencing to be utilized for other programs at other institutions such as Spokane Intercollegiate Research and Technical Institute and Seattle Central Community College.

Asbury Theological Seminary uses full-motion in the classroom such as distance learning, video, production studios, and laptop computers to communicate with its students. Each classroom is equipped with a video information and monitor or projection system connected

via optic fiber. Asbury operates 48 classrooms spreading over 14 buildings and its distance learning reaches far away as Estonia and India. Southwestern Oklahoma State University also is using distance education over an optical fiber network including its two campuses, two high schools, a junior college and a vocational technical center. The optic fiber network was implemented mostly in stabilize its declining population which has effected its educational system making it hard to fill teaching positions. Therefore, distance education allows resources such as teachers to be shared. These are some of the profiles of technology across the nation allowing other campuses to learn and implement.



Punch Down Box



Rack of Hubs



ATM Switch and FDC

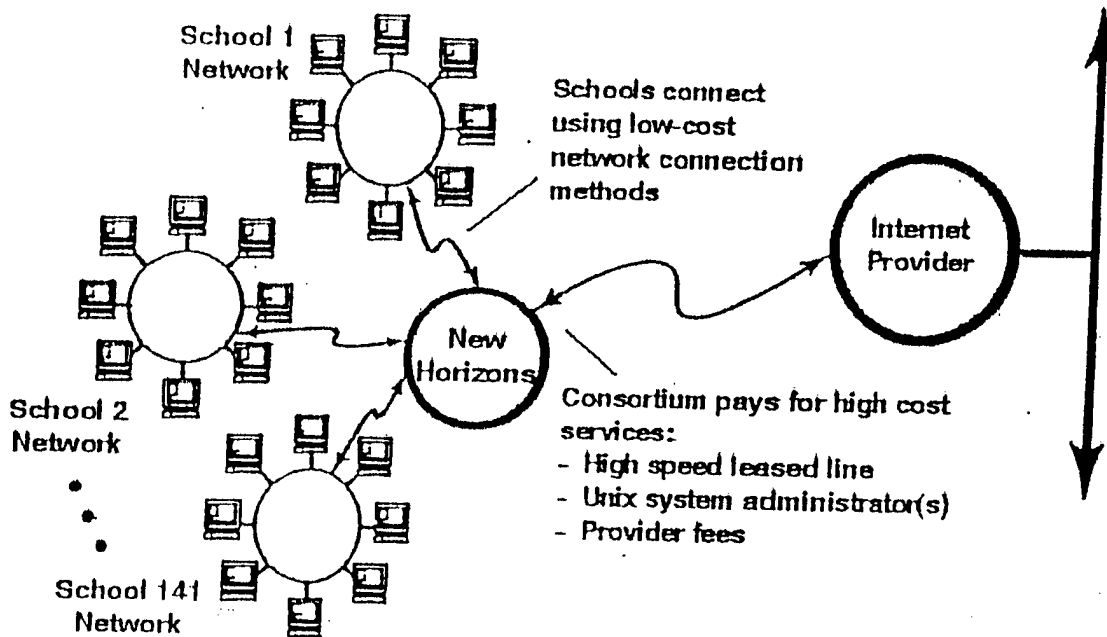
APPENDIX A
(ATM)

APPENDIX B

(ATLAS)

The Wide Area Network

(Using a central site as a connection hub)

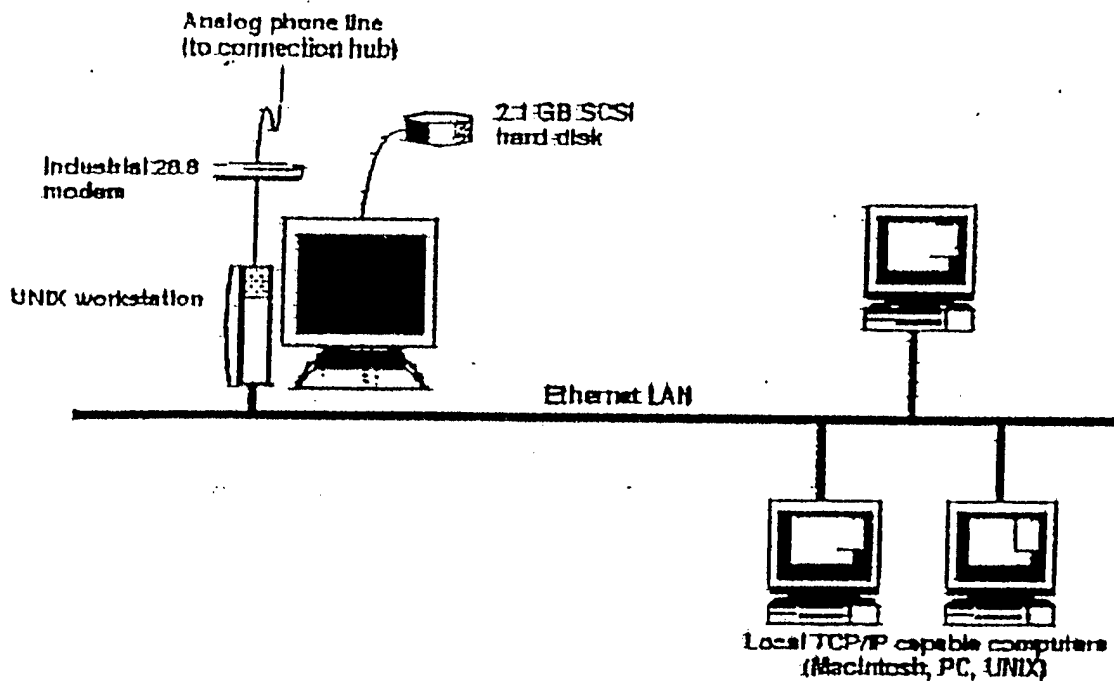


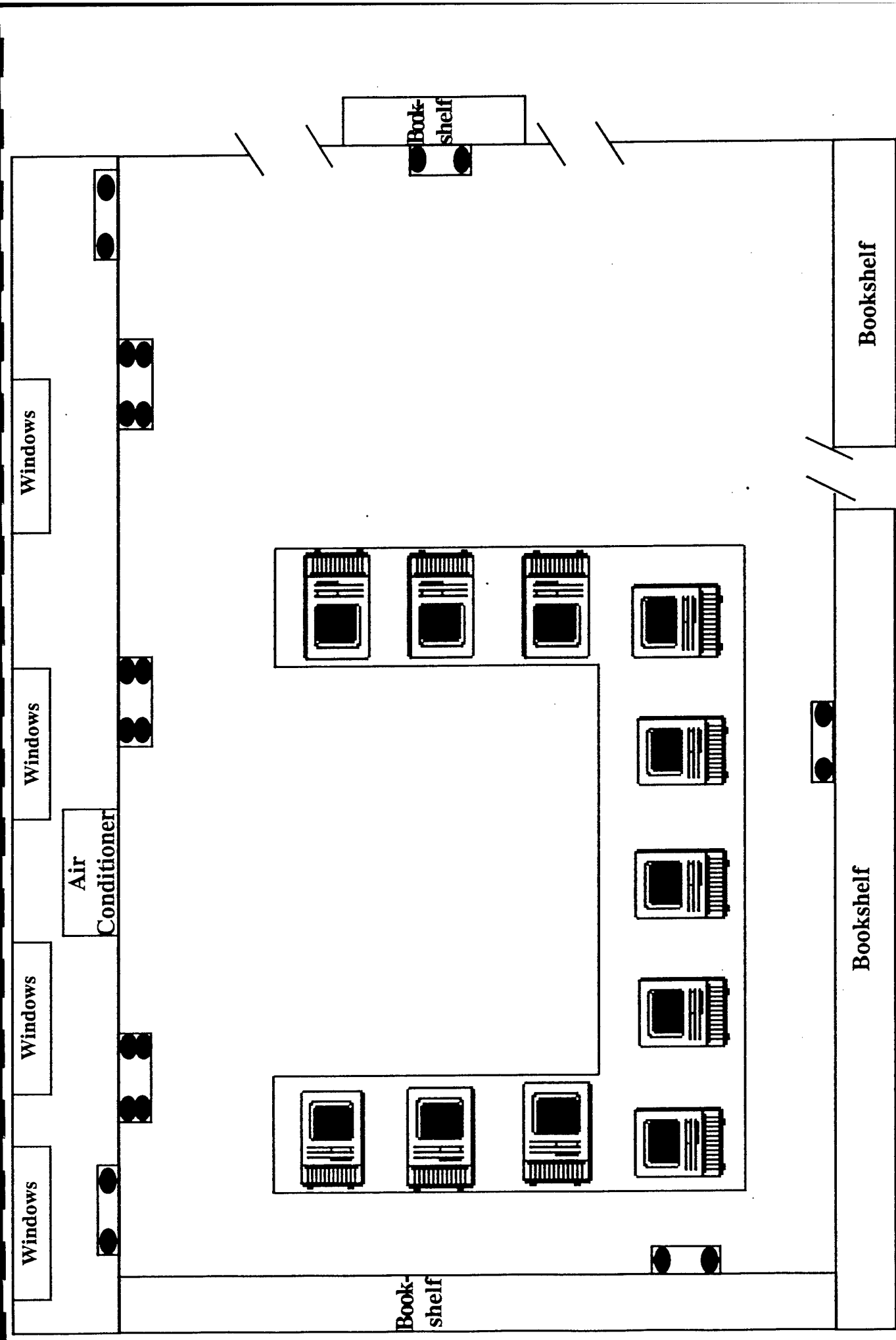
APPENDIX C

(K-12 COMPUTER LAB DIAGRAMS)

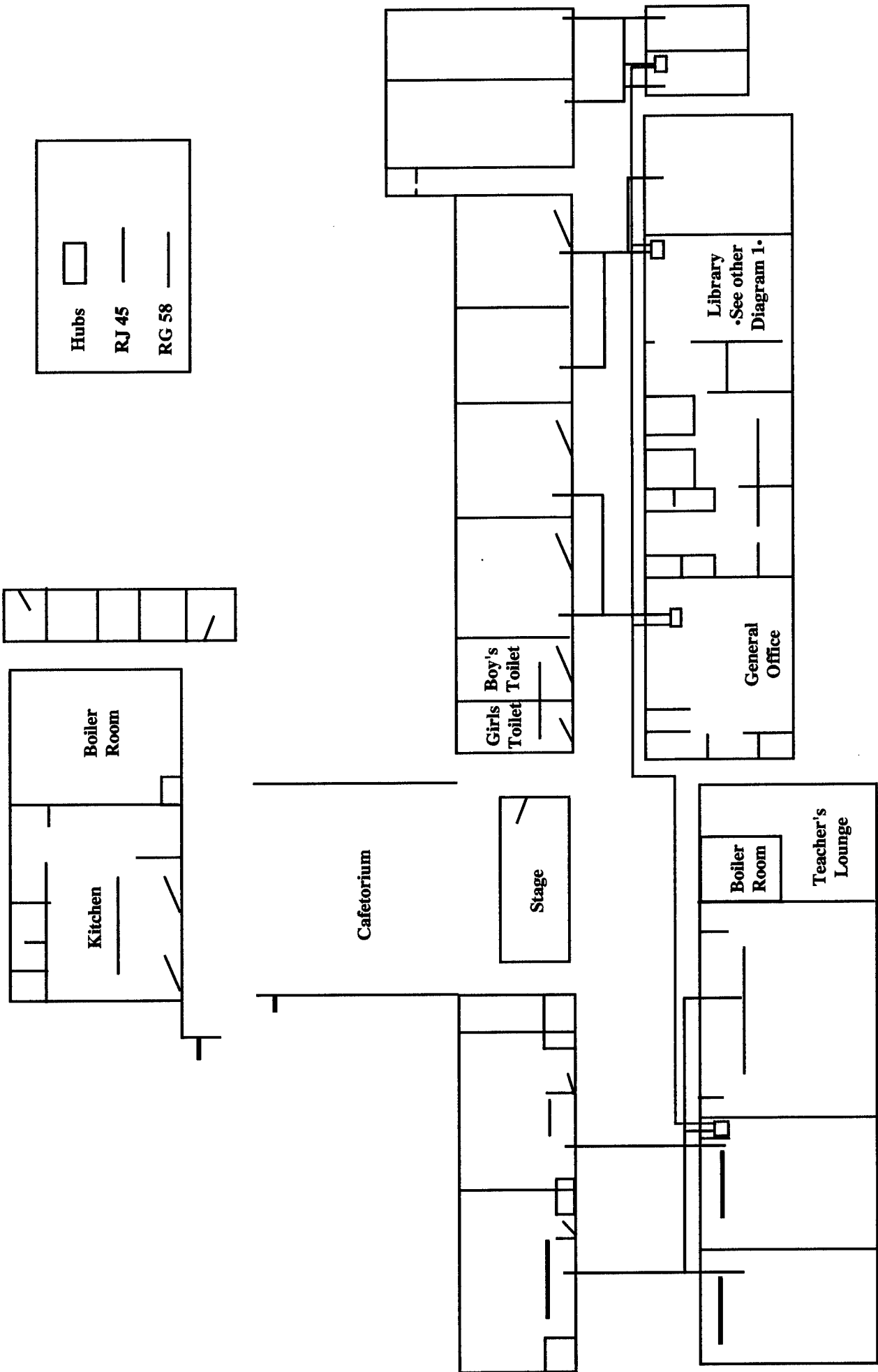
The Local Area Network (LAN)




(The network inside your school building)





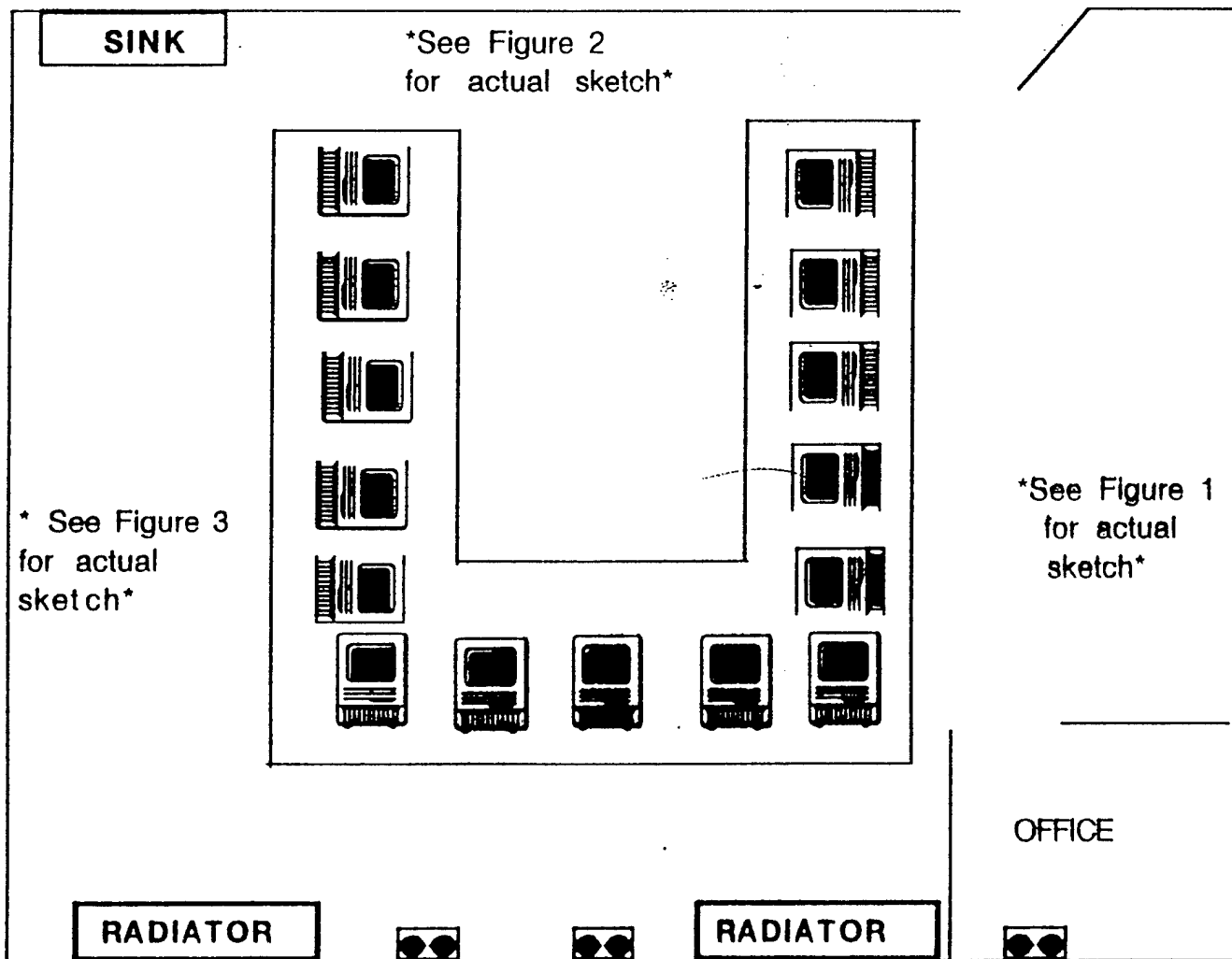
Emily Spong Elementary School's Library



Hubs	
RJ 45	
RG 58	

**Emily N. Spong Elementary School
Current Floor Plan**

DOUGLAS PARK ELEMENTARY



DOUGLAS PARK ELEMENTARY

ACTUAL SKETCH OF WALLS IN ROOM 229

Figure 1

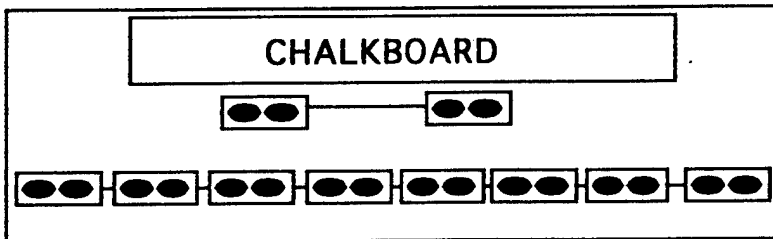


Figure 2

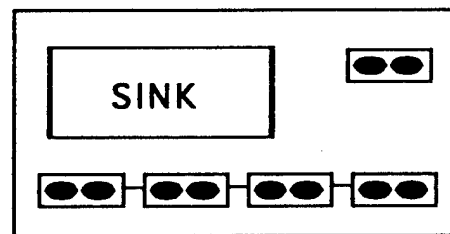


Figure 3

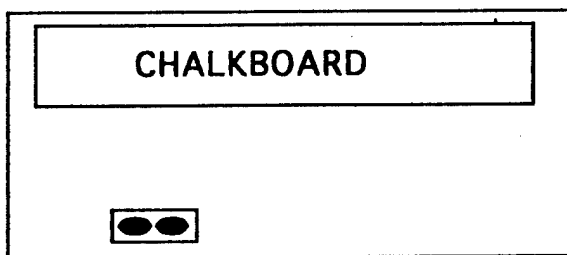
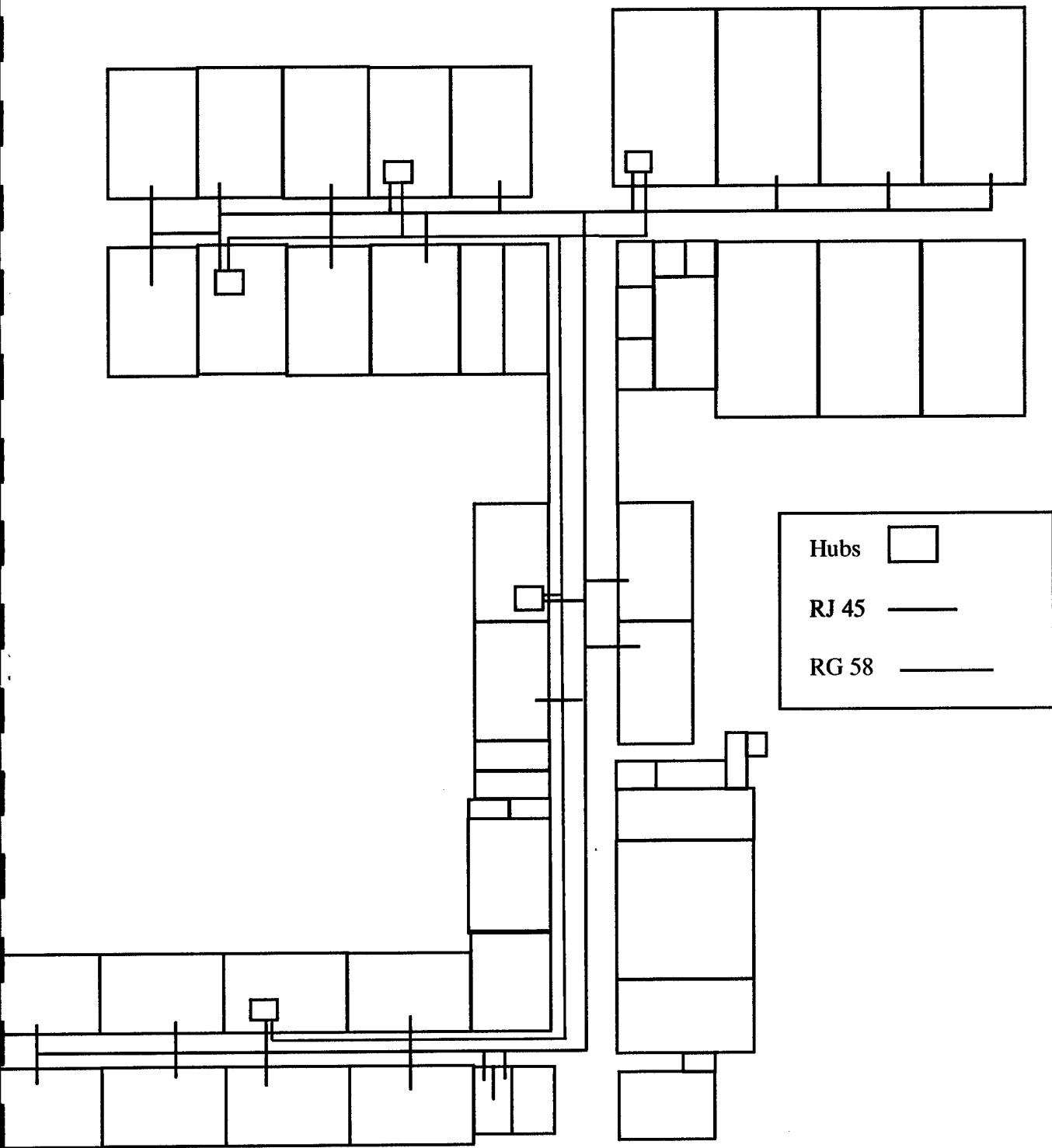


Diagram 2a



Douglas Park Elementary School

I.C. NORCOM HIGH SCHOOL

Room 108

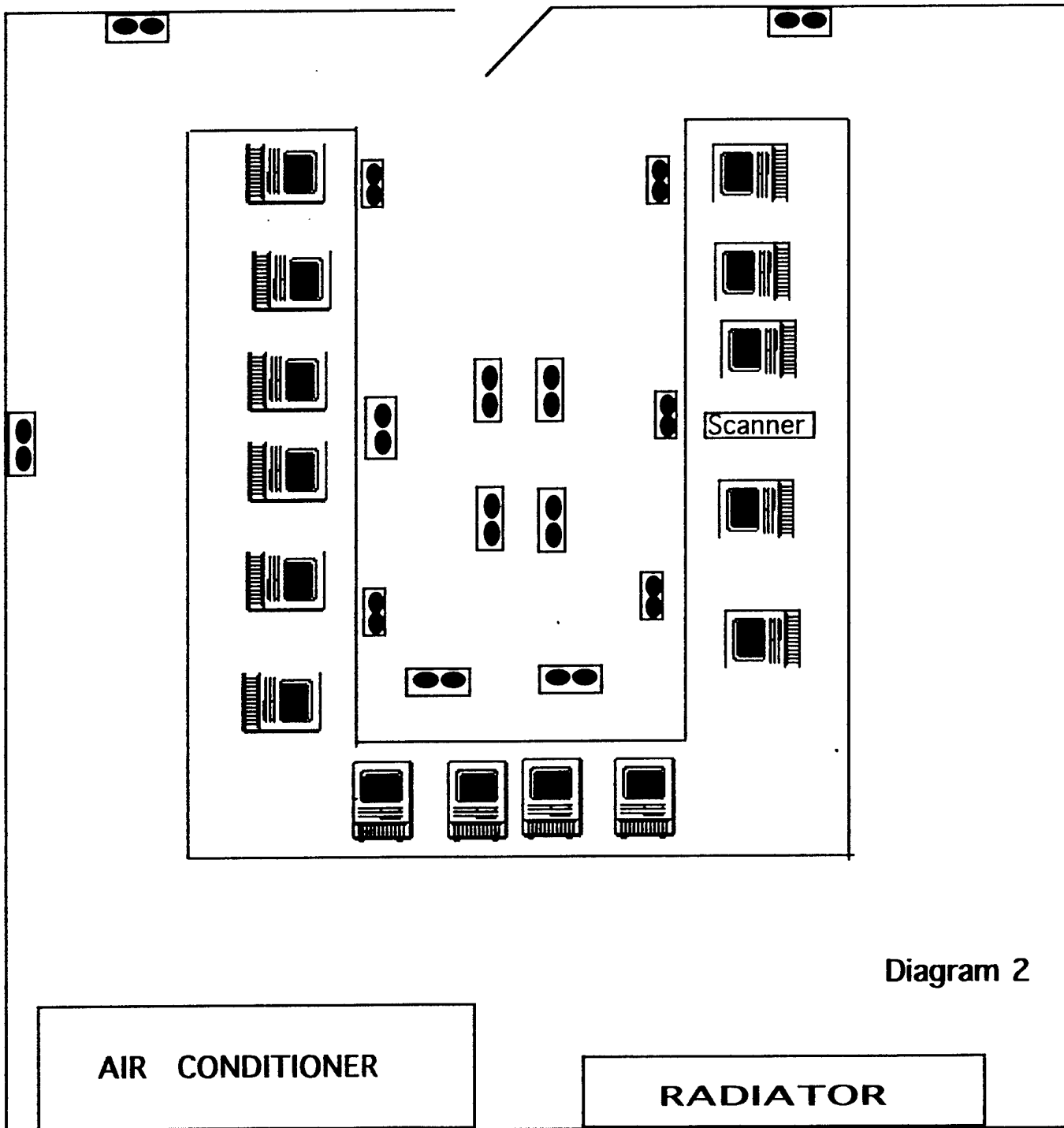
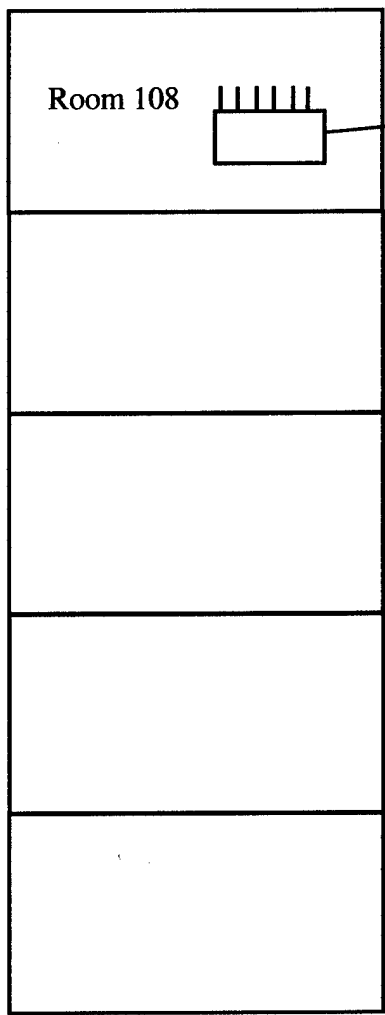
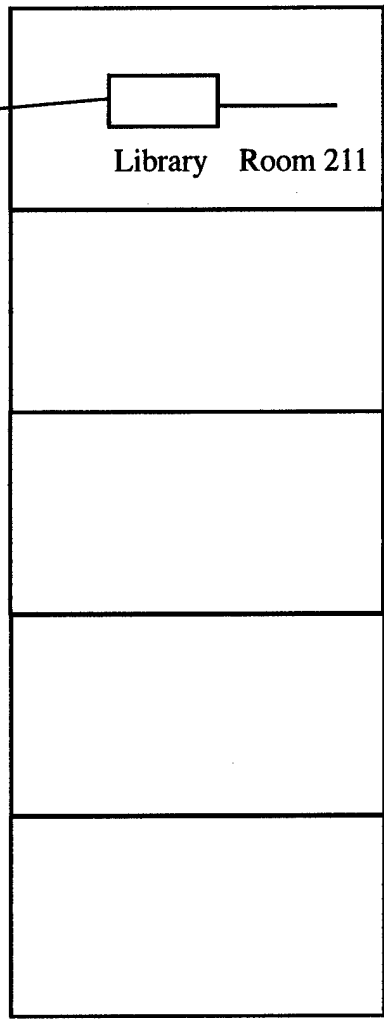


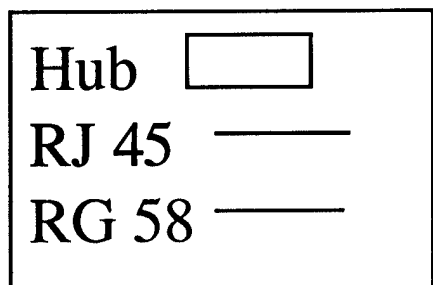
Diagram 2



Left Wing
Right Side
1st Floor



Left Wing
Left Side
2nd Floor



**I. C. Norcom High
School Brief Floor
Plan**

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*Appendix
and
Signature Sheets*



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