ABSTRACT

The Women’s Technology Program (WTP) is a new residential summer school for high school students to live at MIT and study electrical engineering and computer science (EECS). In this thesis I present background research evaluating the state of the current gender imbalance in EECS as well as research describing other initiatives for improvement. I then describe the design and implementation of WTP at a level that it could be replicated by other universities. Finally, I analyze the results of WTP’s first year and present suggestions for future development.
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1.0 Introduction

The Women’s Technology Program is a new summer school for 10th- and 11th-grade high school girls from around the country to explore electrical engineering and computer science at MIT. The girls live on the MIT campus for one month and experiment with hands-on projects under the direction of MIT graduate-student teachers and undergraduate tutors. The project’s two primary goals are:

(1) To convey to the students why EECS is an exciting, worthwhile field; and
(2) To give the students confidence in their ability to succeed with EECS.

Past research suggests that increasing girls’ interest and confidence, more than covering specific technical material, will have the greatest positive effect on their future achievement in EECS (Frenkel 1990, Abelson 1995, Margolis & Fisher 2002).

Figure 1. The 2002 Women’s Technology Program students and staff.
2.0 Background Research

This project was motivated by my experience studying and teaching EECS at MIT with predominantly male students. In the summer of 2001 I taught electronics to a high school group of 30 boys and only 1 girl, and as a TA for 6.034 in fall 2001, all 9 instructors were male and only 6 of my 50 students were women.

While these are extreme cases, there is a measurable gender imbalance across the whole EECS department: for the 2000-2001 school year, 20% of EECS undergraduates were female, compared to 52% of undergraduates in all other departments combined (MIT Facts 2001, MIT EECS Dept. Facts 2000). Likewise, 50% of undergraduate MIT men major in EECS, while for women the figure is 20%. The Tech’s 2002 guide to majors found EECS has the lowest percentage of women out of all MIT departments (Cho & Lin). This significant disparity started me on the path to developing the Women’s Technology Program, and for guidance I looked to research on the state of women in computing.

2.1 Research Analyzing the Gender Imbalance

First, I investigated a report on gender in MIT’s EECS department. In 1993 Prof. Paul Penfield, Jr., the head of the department, commissioned a committee to investigate why the proportion of women entering the department was lower than what would be expected (EECS Ad Hoc Committee; Abelson et al. “Summary”). This committee was chaired by Prof. Hal Abelson and included MIT Dean of Admissions Marilee Jones and EECS administrators Anne Hunter and Marilyn Pierce, among others. In 1995, the committee’s final report verified a significant disparity in women’s enrollment in EECS and noted that “women, much more so than men, feel that they have come to MIT ‘less prepared to major in EECS’ than their peers” (Abelson et al. “Final Report”).

The committee found that MIT performs comparably to other elite science and engineering schools, but lags behind the overall national average. Figure 2 shows that women’s representation in CS degrees nationally actually decreased from a peak in 1983.
The committee recommended stronger recruitment of women interested in EECS and an introduction to EECS for women students with little or no background. The Women’s Technology Program implements both of these recommendations, and by working with high school students, it has the potential to attract young women who would already be turned off to EECS by the time they entered college.

The importance of reaching students early is highlighted by a similar study at the SUNY Geneseo Computer Science Department, which observed that the problem is not one of retention, but rather recruitment (Scragg & Smith 1998). For example, the study found that most women in the introductory courses never planned to major in computer science at all, indicating that barriers had already divided the women and the men even before they entered the program. The researchers’ other major finding was that women entered the university with far less computing experience than men. They recommended outreach programs and mentoring as potential remedies.

Figure 2. Percentage of degrees awarded to women nationally (Camp 1997).
Carnegie Mellon has recently made significant progress based on the research of social scientist Jane Margolis and former Carnegie Mellon dean for computer science Allan Fisher, who noted a significant experience gap even before students came to college:

One of the biggest challenges in middle and high school computer science classes is that many boys enter school with a great deal of formal and informal computing experience. At the heart of this phenomenon is the “magnetic attraction” that motivates many boys to engage in intense self-guided exploration of computing. High schools therefore typically host a subset of students who are already experts who often know more than their teachers. Girls in high school, then, are often sitting shoulder to shoulder in classes with boys who have spent endless hours learning everything they can about computers and who have friends to turn to when they want to learn even more. (Margolis and Fisher 40)

The November 1990 issue of *Communications of the ACM* featured a special section on women and computing. This report noted “[Women] are ill at ease in a field that seems to encourage highly focused, almost obsessive behavior as the key to success,” which is consistent with the Carnegie authors’ view of a culturally encouraged “magnetic attraction” to computers among boys more than girls (Frenkel 38). The *Communications* article quoted Danielle Bernstein, associate professor of computer science at Kean College, who suggested that, “while men may be passionate about computers, women use computers as tools for solving problems. When women do not see computers as efficient tools, they lose interest, but when both sexes see computers as tools, they perform equally well.” In one experiment that asked educators to design software for boys, girls, or students, the researchers found that the programs for both boys and students were game-oriented, whereas those written for girls were classified as learning tools. Beyond illustrating a content bias, this suggests that the designers “may have been simply using ‘male’ as the default value of ‘student.’ ” To overcome these barriers, the report suggested that college CS departments adopt high schools, and create a “cascading pairing” of college students with high school students, graduate students with college students, and so on.

The ACM article referenced an internal publication from MIT’s CS and AI Labs in 1983, *Barriers to Equality in Academia*, which is still available in the laboratory reading room. This publication was prepared by female graduate students, and it is full of quotes illustrating gender prejudices at the time:
“While I was teaching a recitation section, a male graduate student burst in and asked for my telephone number. Men often interrupt me during technical discussions to ask personal questions or make inappropriate remarks about nonprofessional matters.”

“You want to do research? Let me see what I have that you can do… This paper needs proofreading.”

This publication shows that even for those women who do pursue technical fields, discrimination and harassment is a barrier to their professional success.

The above studies all paint a clear picture of an imbalance. The other active area of research in EECS gender education deals with methods for actively correcting the imbalance.

### 2.2 Research Describing Intervention Activities

This section examines four relevant programs and explains how WTP builds on them. The most similar high school program is the MIT Minority Introduction to Engineering, Science, and Entrepreneurship (MITES), which began in 1975 and typically finds that over one third of its 60-70 students attend MIT. The MITES students who attend MIT have a graduation rate as much as 5 percent greater than the general student body (Warde 2001, p. 11). Because of MITES’ sustained success, the Women’s Technology Program uses MITES as its primary role model.

In 1995, Rensselaer Polytechnic Institute ran a two-week residential women’s summer program called PipeLINK for approximately 20 local high school students and 10 undergraduates. The students participated in hands-on activities involving C++, animation, statistics, grammars, and web pages. In addition to those summer activities, several RPI faculty and students visited local high schools during the school year to give presentations and set the schools up with modems to connect to the RPI PipeLINK computer system. Students completed an evaluation at the end of each week, as well as a final questionnaire about the whole program. Over 80% of the students said they would take the program next year, and the faculty recommended their summer program model for use in other settings (Roder & Walker 1996).

A third project similar to WTP is the University of Delaware’s POWER program, an eight-week non-residential Web programming class for high school girls funded by a $100,000 grant from the National Science Foundation. Girls in that program commented that they felt more
comfortable with the material in the all-female group instead of being the only girl in a class of boys at their high school (Manser 2001).

Finally, the most impressive intervention activity has been reported by Margolis and Fisher of Carnegie Mellon’s School of Computer Science. Despite their finding of a significant experience gap even before college, they achieved phenomenal success, raising the percentage of women in their department from 7% in 1995 to 42% in 2000 (Fig. 3).

They employed several techniques to effect this change:

- Based on their finding that prior experience did not predict eventual success, they modified the curriculum to accommodate students with minimal previous experience as well as those with significant experience, and they altered the computer science admissions criteria to put less weight on prior experience.

- Since the female minority was especially affected by poor teaching and material without motivation, they focused on increasing the teaching quality in the introductory classes and putting technology in the context of its real-world uses.

Figure 3. Enrollment trends for women entering the Carnegie Mellon University School of Computer Science. (Reprinted by permission from Fisher & Margolis 2002)
• They publicized their changes through an outreach program for high school Advanced Placement Computer Science teachers that explored both computer science teaching as well as gender awareness.

The Women’s Technology Program includes elements from each of these four programs. MITES provides a successful example of a residential summer high school program, PipeLINK and POWER successfully focused on women and technology, and the CMU research serves to ground the program as part of successful systemic intervention.
3.0 WTP Implementation

3.1 Staffing

This section describes the staff recruitment process and the staff responsibilities and organization.

3.1.1 Staff Recruitment

I hired 11 MIT graduate and undergraduate students for 4 different roles. I began in December by putting out posters and email publicity after I knew I had a budget to hire them for the summer. In January I interviewed almost 30 potential staff members. About 10 expressed interest but were unavailable for one reason or another, and from the remaining 20 I selected the 11 with the best combination of enthusiasm and demonstrated ability. For example, one graduate instructor had received a prestigious departmental teaching award, one TA had completed a Massachusetts teaching credential, several TAs had been camp counselors, and another exclaimed, “Math is fun!” with fervor.

3.1.2 Graduate Instructors

The three graduate-student instructors were each responsible for one of the three classes, electrical engineering, computer science, and math. Each had majored in the area of study she was teaching. The instructors and I began meeting in late February to begin planning the academic program, and they developed a curriculum outline during the semester. In May and early June, the instructors finalized their daily lesson plans together with help from their teaching assistants. During the program they each taught two two-hour classes, since the group was split in half. They often began with a short lecture, and then moved to problem solving or project work. The instructors participated in some of the extracurricular activities outside of class, but they were only responsible for the classes.

3.1.3 Teaching Assistants / Residential Tutors (TAs)

Most of the six TAs were MIT undergraduates. Two teaching assistants were assigned to each of the three classes based on their area of expertise (Figure 4). After the graduate instructor finished a lecture, the TAs and instructor would usually mingle with the students, help with the projects, and answer questions. Students reported that the TAs were very beneficial in giving
them personal attention. Since the classes had only 13-14 students, there was one staff member for every four or five students, which lead to rave reviews of the TAs on the class feedback forms:

“Whenever I raised my hand, she was there.”

“She was very patient and always glad to help; she never ever got frustrated. It was nice to know that I could ask her any question without feeling dumb.”

The TAs also lived in the student dormitory and served as residential tutors to five or six students each (Figure 5). On field trips, the TAs were responsible for making sure their students didn’t get lost; at the 11:00 curfew, students had to check in with their TAs so we knew they were safe; and we could distribute information and supplies to the students most easily through their TAs. This role was especially important in making sure that no student got lost, either literally or figuratively – there was always one staff member directly watching out for every student. Beyond their specific small group, the TAs organized informal outings during the week nights, such as basketball games, museum visits, movie nights, or ice cream tours. As a result the TAs spent a huge amount of time with the students both in and out of class, but they reported enjoying the experience immensely.

3.1.4 Residential Director

The residential director was a graduating senior. She managed the living arrangements for the program and stayed in the dormitory with the students and TAs. She set up the student housing, the meal plan, and the large weekend activities. She made sure all students were safe during outings, and coordinated the TAs and their student groups.

3.1.5 Recruitment and Admissions Director

The recruitment and admissions director was another MIT graduating senior. In February she began an aggressive publicity campaign for the program using postal mailing, email, and the Web. She worked with the MIT admissions office to get a list of 6,000 high-scoring high school students and organized the other 10 WTP staff to help mail 6,000 postcards to them. When we received 225 applications, she helped process the paperwork and design our evaluation process. She led the evaluation process during April until we had our 27 students confirmed. She also corresponded by email and phone with many student and parents about admissions.
3.1.6 Program Director

As program director, I spent most of my time from December through June in preparatory organization. I hired the 11 staff members in January, and then met with the graduate instructors to guide the curriculum development throughout the spring. I worked closely with the recruitment director in the spring and then with the residential director for the summer. I felt comfortable because my background at MIT for 5 years in the EECS department gave me confidence that I could do any of the other staff positions if needed – but I tried to delegate as much as possible, which gave me time to look at the larger picture.

During the program, I tried to facilitate communication between all participants. I met with the staff every day or two as a group to share experiences, and I later met with every student and staff member individually to hear their personal feedback. During the day I spent about half my time observing classes and half arranging last-minute details for guest speakers, weekend events, or administrative necessities like payroll and record-keeping.
Figure 4. Academic staff structure.

Figure 5. Residential staff structure.
3.2 Recruitment

Our recruitment process was very brief. Our Web site (http://wtp.mit.edu/) went public at the start of February, and applications were due just two months later, on April 1st. We promoted the Web site through links from other MIT Web pages, by email, and through direct postal mail. We targeted 10th and 11th grade students because we felt that age group would be able to handle interesting material (similar to MITES or PipeLINK) and two grades would provide more potential students than just one.

3.2.1 Direct Mailing

Our direct mailing was the most effective publicity method. The MIT admissions office provided us with a list of the 6,000 top-scoring female students on the PSAT exam, and in mid February we sent each one a postcard with a brief description of WTP and an invitation to see the Web site. Figure 6 shows the dramatic result of that mailing: the web site traffic jumped from about 1,000 page-requests per week up to 4,000. After two weeks, it dropped back to 2,000 pages per week until the application deadline. Figure 7 shows that the majority of the students who downloaded the application had heard about the program by the postcard mailing.

![Figure 6. Web site traffic during the recruitment process.](image-url)
3.2.2 Web Site

We chose to use a Web site as our primary publicity medium instead of preparing a paper brochure. This allowed us to collect more information to monitor the recruitment process, such as the number and origin of viewers. The Web site contained the following information:

1) Home page Single-paragraph description and breaking news.
2) Academics A basic paragraph description of the academic goals, and a longer description of each class. Suggested academic preparation for students.
3) Student Life A description of housing, food, and extracurricular activities.
4) Calendar A timeline of the application process and summer school dates.
5) Application A description of eligibility and cost, and a short survey before you can view the application.
6) Questions A list of frequently asked questions sorted by topic.
7) Staff Short biographies of the teaching staff.
8) Contact Us Email, phone, and postal addresses.

![Comparison of how applicants found the web site](image)

**Figure 7.** Comparison of how applicants found the web site. From 547 surveys submitted when they downloaded the application.
It was useful to be able to update the Web pages on-the-fly. For example, as we refined the academic content, we could publish a more detailed description of the classes. Similarly, the frequently asked questions section allowed us to answer the most common inquiries. The online survey form before downloading the application and the Web server statistics were very useful in allowing us to gauge the effectiveness of our methods. If only 10 students had completed the survey by mid-March, we would have known there was a problem and we could have pursued more publicity and extended the application deadline.

3.2.3 Results

By early April, we received 225 applications. 40% were finishing 10th grade and 60% were finishing 11th grade. We recruited both ages indiscriminately because we wanted to get more applications. Figure 8 shows that we received applications from all around the country. The greatest number of applications came from California (40), Texas (22), New Jersey (18), and Massachusetts (16). The median applicant PSAT score was a 215, 99th percentile nationally, and the median SAT was a 1430 (96th percentile), which reflected the fact that our applicants had been recruited by high test scores.

![Figure 8. Geographic source of applicants. State abbreviations in parentheses are ordered by number of applications received from that state.](image-url)
3.3 Admissions

Admission to WTP was based on an application that included high school grades, test scores, essays, and a recommendation. We evaluated the candidates for academic potential and personal motivation to select 27 students.

3.3.1 Application

The application had five sections:

1) Biographical Basic contact information.
2) Academic Grades received in high school science and math courses.
   Test scores: ACT, PSAT, SAT I, SAT II math/science.
   A complete transcript was also required.
3) Essays Three single-page essays concerning the student’s motivation and background:
   • Why do you want to attend WTP?
   • What do you find interesting or exciting about technology?
   • What is your most important extracurricular activity?
4) Teacher Recommendation A recommendation from a science or math teacher.
5) Financial Aid Admission was independent of financial aid, but the financial aid page of the application was used for admitted students.

3.3.2 Evaluation Process

We evaluated the candidates’ academic background mostly by looking at their grades. Competitive students had received A grades in several science courses and were taking calculus or planning to take it next year. Test scores also influence the academic evaluation; strong candidates had test scores in the top few percent nationally. Finally, we also considered the teacher recommendation and any outside awards (such as science fair prizes).

We also gave each application a personal rating which reflected how much we thought the applicant would benefit from and contribute to the program. This rating was based largely on the essays – highly-rated students tended to have essays that gave a sense of their personality and personal accomplishments and drives. The teacher recommendation was also useful here as a third-party evaluation of the candidate, and we also took into any other relevant details from the application, such as a financial aid form that described a difficult home situation.
Figure 9. Number of applicants receiving scores. Darkly highlighted cells were accepted; lightly highlighted cells were considered for the waitlist.

Each application was read and evaluated separately by at least two of the WTP staff members. When the two readers disagreed, the application got a third read. We compiled the scores in a database and plotted them on the grid shown in Figure 9.

The students with the highest scores in both areas were immediately admitted. Then we created a waiting list of 20 students, favoring the students with a slightly weaker academic background but exceptional personal motivation. When a few of the initially accepted students declined, we admitted a few students from the waiting list until we had the number we were looking for.

3.4 Academics

The academic program was designed to meet the program’s two goals of exciting and empowering the students. Guest lecturers shared their excitement by describing and demonstrating a variety of cutting-edge research in EECS, and the three regular classes built the students’ confidence with challenging work representative of what they might face studying EECS in college. After three weeks of classes and guest lectures, the students completed two special projects: a motor class and a robotic surgery challenge.
3.4.1 Classes

The students were split into two groups, and each group took all three classes, each one for two hours (Fig. 10). This arrangement kept the staff-to-student ratio small, and meant that the instructors taught each class twice a day. The emphasis was on active learning, meaning that rather than the instructors giving long lectures to passive students, the students spent most of their time actively engaged in writing programs, building circuits, solving problems, and working in teams. This approach was based on the results from PipeLINK that “hands-on labs were strongly preferred” over lectures (Rodger & Walker 1996) and recent news articles and reports which strongly support “hands-on research and links between science and real world problems” (Krieger 2002) and “curricula designed to emphasize problem-solving applications of science and technology” (NCRW 2002) as tools for encouraging women in science and technology. Appendix C gives day-by-day outlines of the class material.
3.4.2 Computer Science

This class taught introductory programming using Java through two related projects. The class assumed no prior experience and focused on teaching students enough to write and understand fun and interesting programs on their own rather than covering computer science theory. Students received the book *The Object of Java* by David D. Riley as a reference, and the projects used the straightforward graphical library from the book.

For the first project, each student designed a letter of the alphabet graphically, from scratch, using rectangles, ovals, and lines. This gave the students practice using pre-existing Java classes and functions and taught them how to write their own functions for other students to use so that the whole class together produced a complete font. This graphical approach let all students immediately see the results of their code visually in order to make it an engaging process, and it connected to fonts and word-processing, practical applications with a clear utility. The open-ended nature of the project meant that all students could make basic shapes to form a letter, and the more advanced students had room to be creative by designing fancy letters and implementing more advanced features such as scaleable letters.

For the second project students created programs to recognize hand-drawn letters. This involved learning about algorithmic design, conditional programming statements, and loops. Students worked in pairs for this final project, which let them practice interfacing their individual code together as well as the “extreme programming” software design technique of two people working together on a single machine. This project added greater interaction to the graphical system developed in the first project by allowing students to draw letters and immediately observe their programs’ attempt to classify it as one of 26 letters of the alphabet. It also let less advanced students complete basic recognizers for simple letters while more advanced students could tackle harder letters and even create a generalized abstract system to handle more difficult cases.

The two projects ultimately connected so that a user could write text on the screen and the computer would convert the hand-drawn text into the font created in the first project (Fig. 11). The utility of the projects was apparent, since the students were essentially designing the same process found on commercially available hand-held computer organizers that need to recognize hand-written text.
3.4.3 Electrical Engineering

This class focused on building and understanding circuits. Each student received a 500-in-1 project kit manufactured by Maxitronix, which they used for experiments throughout the class. It was useful that the kit provided all the components and circuit diagrams needed for each of the 500 projects listed in the manual that came with it so that the instructor had working, tested circuits to choose from. They also used the book *Practical Electronics for Inventors* by Paul Scherz as a reference to supplement in-class explanations.

Students began the electrical engineering class working in pairs to experiment with current, voltage, and resistance using organic material such as food. They studied basic electrical components such as resistors, capacitors, inductors, and then moved on to more advanced non-linear devices, diodes and transistors. The students made an important connection to the mathematics class when they designed and constructed physical AND, OR and NOT logic gates.
using transistors, demonstrating the link between theoretical logic and physics and exploring the foundation of all modern computing.

The last directed project involved the construction of an AM radio. After building the radio circuit, the students formed teams to analyze the different stages of the radio, such as the receiver, amplifier, and filters, and present their analysis to the class. During the last week, students built individual projects of their own choice, taken from a book of samples.

### 3.4.4 Mathematics

The math class covered a variety of topics applicable to EECS rather than focusing on a single area. It used the book *Discrete Mathematics and Its Applications* by Kenneth H. Rosen as a textbook for many of the topics; the book had practice problems pre-made for the instructor and allowed the more advanced students to read more on their own. Students also read and discussed sections of the book *Engines of Logic: Mathematicians and the Origin of the Computer* by Martin Davis, which described biographies of famous mathematicians whose work underpins modern computing.

The class began with number systems, binary operators, and then moved into formal logic, and proof styles such as induction. One of the math TAs presented a unit on her favorite material, connecting graph theory to a wide range of real world applications. The class finished with algorithmic analysis and computability/complexity theory. Students spent a substantial portion of the class working on practice problems collaboratively with help from the instructors and presenting their solutions on the chalkboard. For homework they had optional practice problems covering the day’s material so they could verify their understanding, as well as more advanced “concept problems” that often required substantial thought but minimal writing. For example, the first concept problem was to design a binary number system that could handle negative numbers and subtraction. These concept problems were designed to challenge both advanced and beginning students to think creatively and design their own solutions.
### Table 1. Guest Lectures.

<table>
<thead>
<tr>
<th>Date</th>
<th>Lecturer</th>
<th>Topic</th>
<th>Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/25</td>
<td>Prof. Victor Zue</td>
<td>Speech Recognition</td>
<td>Powerpoint and live demos</td>
</tr>
<tr>
<td>6/26</td>
<td>Prof. Leslie Kaelbling</td>
<td>Machine Learning</td>
<td>Powerpoint</td>
</tr>
<tr>
<td>6/27</td>
<td>Grad. Jessica Banks</td>
<td>Humanoid Robotics</td>
<td>Lab tour</td>
</tr>
<tr>
<td>6/28</td>
<td>Grad. Emily Cooper</td>
<td>Semiconductor Fab</td>
<td>Powerpoint and tour</td>
</tr>
<tr>
<td>7/1</td>
<td>Prof. Nancy Lynch</td>
<td>Computability Theory</td>
<td>Chalkboard</td>
</tr>
<tr>
<td>7/2</td>
<td>Prof. Mildred Dresselhaus</td>
<td>Carbon Nanotubes</td>
<td>Transparencies</td>
</tr>
<tr>
<td>7/3</td>
<td>Dr. Vanu Bose</td>
<td>Software Radio</td>
<td>Chalkboard and demo</td>
</tr>
<tr>
<td>7/5</td>
<td>Prof. Judy Hoyt</td>
<td>MOSFET Miniaturization</td>
<td>Powerpoint</td>
</tr>
<tr>
<td>7/8</td>
<td>Dr. Una-May O’Reilley</td>
<td>Artificial Evolution</td>
<td>Powerpoint and discussion</td>
</tr>
<tr>
<td>7/9</td>
<td>Lorelle Espinosa</td>
<td>College Admissions</td>
<td>Discussion</td>
</tr>
<tr>
<td>7/18</td>
<td>Dr. Idit Harel</td>
<td>Children’s Media</td>
<td>Powerpoint and demo</td>
</tr>
</tbody>
</table>

#### 3.4.5 Guest Lectures

The 11 guest lecturers covered a huge array of topics in both computer science and electrical engineering. Most were MIT faculty and graduate students, but a few were given by MIT alumni from the business world. Several included a demonstration of the technology described or a laboratory tour (Table 1).

#### 3.4.6 Special Projects

The students began their last week with a 3-day motor-building project led by MIT electrical engineering professor Steven Leeb, based on his January seminar class (Leeb 2002). First they learned the basic equations of electromagnetism that apply to a direct-current electric motor, and then they had a safety orientation for the machine shop they would be using. For the second and third day of the project, they worked in teams of two to design and manufacture a motor to achieve the highest revolutions-per-minute possible. During this phase they had access to a drill press, band saw, milling machine, and lathe, with supervision from lab technicians. They were given plexiglass sheets and cylinders along with magnets and wire. This project gave students a great deal of freedom to experiment and construct novel designs. Most students constructed a rectangular plexiglass frame with magnets around a single 4-6 inch rotor with wires, but other groups built hexagonal designs, multiple or tiny rotors, and a “stepper motor” with the magnets and wires reversed from the usual orientation. Several teams constructed motors running at 2000-4000 RPMs, and most teams ended with a working product.
The second special project was led by the Computer Integrated Surgery Student Research Society from Johns Hopkins University, of which one of the TAs was a member. The project was based on an annual competition run by the student group for the past three years (CISSRS 2002). Teams of three students each were challenged to construct a robot capable of autonomously biopsying a grape suspended in jello, to simulate a tumor in a patient. The robot had to complete three stages: visually scanning the jello with light sensors to find the grape, positioning a needle at the appropriate place for it to strike the grape, and actually piercing the grape with the needle when a human pressed a button. This project involved both a programming aspect using a visual LEGO language the students had used earlier as well as the construction of the mechanical and electrical apparatus. In this way, the two projects tied together material from all of the classes into practical applications.

3.5 Residential Life and Entertainment

This section describes the various issues involved in the residential system of WTP.

3.5.1 Housing

All students lived in double rooms on two adjacent floors of an MIT all-women’s dormitory. The TAs lived in single rooms nearby. They had access to common space for activities like music rehearsal, games, and movies.

3.5.2 Food

Each student received a meal card with $90 per week for food. The cards were accepted at campus cafeterias and a grocery store. Students had access to kitchen facilities in the dormitory, which they used mostly for breakfast food. We also often provided food at extracurricular events.

3.5.3 Policies

Our policies were strict because the students were minors and we wanted to make sure there was no trouble during this first pilot year. Our major policies were:

1) Students may not leave campus alone, and must sign out when they leave.
2) Students must return to the dormitory by 11:00 on weeknights and midnight on weekends, and must be in their rooms by 1:00 a.m.
3) No alcohol or illegal drugs.
4) No boys in room with door closed or after 11:00 p.m.

3.5.4 Airport Shuttle
About half of the students arrived by air on the check-in day. One TA drove a van to shuttle the students from the airport to MIT while several TAs met students at their airport terminals and the rest helped students get settled at the dormitory.

3.5.5 Orientation
Our orientation began the morning after students arrived. After introductions and brief welcome speeches, students split into their TA groups for a scavenger hunt to familiarize them with the campus. After lunch we took a Duck Tour of Boston to see what was beyond the campus.

3.5.6 Organized Events
We scheduled large outings for the weekends and encouraged all students to attend. These began with a whole-group camping trip to an MIT Outing Club cabin, and included visits to the aquarium, the beach, the Boston Harbor Islands, and Walden Pond. After the first weekend, the events were not mandatory, but they provided an option that most students took.

3.5.7 Dinners with Academic Societies
We arranged dinners for the WTP students to meet with an EECS graduate women’s group, the Society of Women Engineers, and undergraduate women in the department. These dinners were a chance for our students to hear about different academic career paths in casual settings.

3.5.8 Informal Events
At least one TA arranged an informal outing every night of the week. These were not required at all, but provided an option for students who would otherwise have been lost. Examples were games of basketball, Frisbee, and capture-the-flag, and visits to museums and ice cream shops.

3.5.9 Tutor Manual
The full staff met during the week before the students arrive to finalize preparations. Most of the time was devoted to preparing the classes, but the TAs and Residential Director also met to discuss a residential manual we prepared to assist the TAs in their role as residential tutor. The
manual made the job description and expectations explicit, provided suggestions for working with students and handling difficulties, outlined conflict resolution strategies, covered WTP residential policies, and provided emergency information.

### 3.5.10 Student Web Site

I maintained a private web site for the students and staff to use throughout the program. It was most useful for posting announcements and events on an updated calendar, but we also used it to distribute class material and post photos taken from events. Figure 12 shows very high Web site traffic during the program (5,000 to 10,000 page requests per week), which reflects both publicity about the program generating outside interest, as well as a high usage level by the students and parents.

![Figure 12. Web site traffic during the program by week.](image)
3.6 Finances

This section outlines WTP’s costs and income. Appendix B has a complete budget breakdown.

3.6.1 Expenditures

75% of the total program cost came from staff salaries, housing, and food (Fig. 13). It was hard to pay MIT students enough to staff a four-week program to make it worthwhile for them, since the program prevented them from obtaining a full-time summer job in industry. The staff salaries in Figure 13 include a 15% bonus paid at the end of the program in recognition of their good work, as well as my full time graduate research assistantship stipend and tuition. Housing was expensive because the dormitory charged us the same rate as conference guests instead of the MIT student rate, and food simply added up to a lot, including the final banquet and sponsored dinners. We let the students keep their textbooks and lab supplies since it was a relatively small cost and saving them would have locked us into the same program for next year. I felt that giving the students the academic materials supported our goal of encouraging them to pursue EECS on their own.

3.6.2 Income

For this pilot year the program was fortunate to receive strong support from the MIT Chancellor, the School of Engineering, and the EECS Department (Fig. 14). The department committed to running the program and handling whatever expenses were left over. This gave us the luxury to keep tuition to a low $1000 so as not to discourage potential students from attending. We also provided financial aid in the form of reduced fees and travel assistance to students who requested it.

3.6.3 Fundraising

The department hopes to run the program annually in the future with the support of contributions from charitable foundations and corporations. Luckily, it seems that the issue of women in engineering and science is a current, relevant issue that should be able to find such support.
Figure 13. Total program expenditures.

Figure 14. Total program income.
4.0 Analysis

This chapter presents an evaluation of the first year, recommendations for future improvement and evaluation, and suggestions for starting similar programs at other universities.

4.1 Evaluation of the First Year

This section describes the results of the first-year program. I analyzed student surveys to determine the program’s success in meeting its two goals of increasing student interest and confidence. Approximately 80% of students reported greater interest and confidence, indicating that the program successfully inspired and empowered them to work in EECS. Logistically, the program experienced no significant problems, and the students reported being impressed at how well it ran, especially as a first-year program.

From my observations, the excellent staff was the single most important factor in the 2002 program’s success. After investing effort, they developed a sense of personal caring and responsibility for the program. This manifested itself in their willingness to go beyond the requirements of the position, for example by collectively devoting hundreds of hours to coming in on weekends to label postcards and read student applications.

4.1.1 Recruitment Results

The recruitment process met and exceeded its goals. I had set the target of reaching 5,000 to 10,000 students in order to solicit 100-200 applications from which to pick 25. The direct mailing to 6,000 was clearly the most effective form of recruitment for the first year on such short notice, but I expect that in future years as the program becomes better known, word-of-mouth and reputation will play an important part. I expect that merely by repeating the recruitment strategy of 2002, the number of applicants could easily increase from 225 to 400 for the 2003 program based on more widespread knowledge of the program.

While high test scores were not ultimately the most important quality we were looking for, I believe the direct mailing to high-scoring students was important for its ability to reach students not attending top academic high schools, especially in rural areas, but who stand out and distinguish themselves as academic achievers. Despite the correlation we observed between high
test scores and highly academic high schools, this still offers outstanding students a positive
opportunity to distinguish themselves.

4.1.2 Admissions Results

By basing our admissions decisions largely on “personal motivation” after selecting a strong
academic group, we ended up with a very outgoing and enthusiastic group of students. We had
been concerned that we might end up “preaching to the choir” by helping only those girls who
were already certain to major in EECS, but that turned out not to be an issue. Almost none of the
students arrived saying they wanted to major in EECS – but they were all excited about the
chance to take classes in the field at MIT for the summer. They tended to have a wide variety of
hobbies beyond their strong academics; many were talented musicians or dedicated athletes. For
most, it was their first time in a setting with such a talented peer group – it was no longer
uncommon to have extremely high test scores and superb grades in math and science.

One of our largest concerns with the admissions process was the possibility of discouraging the
nearly 200 girls we rejected. Running a highly selective program may give the organizers a
sense of being elite and successful, but it runs the risk of making the whole program
counterproductive with respect to its fundamental goal of encouraging women in EECS. To
combat this, we tried to make clear in the rejection letter that the most important factor was not
their lack of talent or ability, but our limited space for the first year of the program. This was
true, since the vast majority of our applicants had sufficient academic background to attend the
program. We encouraged the rejected students to apply to MIT, and to WTP again if they were
sophomores, and I provided the MIT admissions office with a list of 160 applicants that we
recommended as strong candidates, so that the admissions office could recruit them to MIT.

Another issue I encountered when we received the applications and again when we chose our
accepted students was the lack of variety in ethnic and socioeconomic background. We didn’t
consider ethnicity at all in admissions, and our resulting students were close to 60% white and
40% Asian. We only looked at financial aid requests as a potential positive indicator of
overcoming a difficult home situation, but while 27% of applicants requested financial aid, only
19% of admitted students requested aid. These numbers suggest a gap in academic preparation
linked to ethnicity and financial background.
4.1.3 Class Results

This section describes general class-related issues and explains the results of each of the three classes. My largest concerns for the classes were making them stimulating and engaging while balancing the wide variety of student backgrounds. Approximately half the students had no background in the class material, while half had taken some preparatory high school subjects. I focused on these two issues with the graduate instructors in the spring and in training, and in the end they did not become major problems.

The computer science class was most accessible to the students because most of them were already comfortable writing documents on a computer and they could immediately begin writing Java code in a similar way. Surveys and instructor comments indicate that the creative aspect of the two projects was very successful at engaging the students, allowing them to visually see and interact with the programs they wrote. The projects were open-ended, which let the advanced students explore various creative extensions, while the less advanced students found satisfaction in completing the basic requirements successfully. At the end of the class, the instructor was skeptical of the students’ mastery of loops and conditionals with user-supplied data in such a short amount of time. Nevertheless, Figure 15 shows that students were overwhelmingly positive about the class: every survey reported an increase in interest for computer science, and almost a third of the students reported a great increase in both their interest and confidence. These attitudes were manifested in class surveys:

“[I feel] much more confident. I used to think I’m not the type of person for CS, but I really enjoyed it.” (student survey #7)

“I knew just a little about programming (almost none, I would say), [and found it] intimidating. Although it was difficult from time to time, actually programming by myself was an invaluable experience. I’m actually considering majoring in CS!” (survey #15)

The electrical engineering class presented most students with more of a challenge. About 40% of the students had taken some level of physics, so some had seen resistors, capacitors, and voltage, but very few had any practical experience with designing, building, or analyzing circuits. Its practical hands-on focus made the EE class very engaging for most students, and gave them the freedom to experiment on their own with the components. Many were drawn in
by the opening demonstrations and experiments involving measuring voltage and current through organic material (the first lecture started with the electrofluorescence of a pickle).

The instructors and surveys reported that some students who had not taken physics were intimidated by their lack of knowledge and felt they could not be expected to keep up with the students who had more experience. Figure 16 shows a sizable minority of students who felt their interest in EE did not change significantly, but 70% of those students still reported positive feelings about the class, such as, “EE was a confusing class, but I still learned a lot here.” (survey #2) Despite the mixed reports on interest, most students still indicated that their confidence with EE increased, even those who were not as interested in the material. This might result from a lack of practical applications to inspire students even though they successfully completed the projects. However, several students commented that they particularly liked the connection to the Boolean logic of the math course when they built AND, OR, and NOT gates using transistors.

Because the mathematics class covered a variety of topics rather than focusing on one area, most students found something new and interesting, as shown on the left side of Figure 17. However, the breadth of material actually made some students less confident about their ability with mathematics when they realized that there were many more math topics than the traditional geometry-algebra-trigonometry-calculus high school curriculum. One student whose interest increased but confidence decreased wrote, “It exposed me to new types of math. I am more used to concrete math, but I would definitely like to learn more.” (survey #10) There was almost no correlation (0.07) between reported interest and confidence, reflecting the fact that most students reported an increase in at least one area.

The instructor commented that the in-class work was especially useful in getting students to immediately understand concepts rather than waiting until that night, but two hours was a long amount of time to keep the students’ attention. That reflected the difficulty in making the math class hands-on and active in comparison to the CS and EE classes. Many students found the “concept problems” very challenging and stimulating, though some complained that they took a long time to figure out. Even though the homework was optional, most students completed it all.
Figure 15. Computer Science class survey results for interest and confidence.

Figure 16. Electrical Engineering class survey results for interest and confidence.

Figure 17. Mathematics class survey results for interest and confidence.
The students were very satisfied with the classes as a whole:

“We covered so much more than I expected; however, surprisingly, it wasn’t as difficult as I thought. I expected that EECS would be extremely difficult and complex, but now I know it is very possible to learn.” (survey #9)

The instructors and TAs reported that the training week before the start of the program was very useful in preparing them for teaching. The graduate instructors had finished most of their material ahead of time, but by meeting with the TAs every day of the week before classes, they were able to finalize the details and get the entire staff on the same page. The instructors with less experience commented that practicing teaching every afternoon during the training week was the most valuable exercise of the week, and it also let the staff observe each other’s style and discuss teaching methods.

4.1.4 Laptops

We provided each student with a laptop computer loaned to us through the MIT Council on Educational Technology. The laptops were used most extensively for the computer science class, where the computers’ wireless networking cards allowed students to seamlessly share source code. We also equipped our section of the dormitory for wireless Internet access so students could work together in their rooms and recreation areas. After some initial configuration difficulties, the laptops worked fine throughout the whole program. Students commented that the laptops helped them keep in touch with family and friends, and were difficult to let go of at the end of the month. I considered this a positive experimental result because of research indicating that girls are less likely than boys to have access to a computer at home and are less likely to have a computer in their room when their family owns one (Margolis & Fisher 2002, p. 23). On the other hand, there was some indication that the laptops and Internet access kept students up at night when they would otherwise have been sleeping.

4.1.5 Guest Lecture Results

I felt that the guest lectures were valuable for exposing students to the full breadth of EECS, from theory to semiconductors to business to human-computer interfaces, and student survey results were mostly positive. Figure 18 shows that one lecture was rated superb, 6 were rated as good, three were rated okay, and only one was poor. Figure 19 shows the aggregate ratings for
all lectures, with positive ratings of good and superb outnumbering negative ratings by almost a factor of four.

Students commented that the best lectures were those appropriate to their level of scientific knowledge, explaining enough to make the material interesting without losing the students in technical details. Many lecturers made the mistake of trying to cover too much material, going over-time, not leaving enough time for questions, and generally not being interactive. After our highly interactive and hands-on classes, it was hard for a lecturer to deliver a talk in which students sat in their chairs and listened for an hour without seeming boring. The best lecturers overcame this by sharing entertaining demonstrations of their actual work and breaking the ice with the students through informal discussion. The students also enjoyed visiting other areas of campus, though that left less time for the actual content of the talk.
**Figure 18.** All lectures sorted by average rating.

**Figure 19.** Average student evaluations for all guest lectures.
4.1.6 Special Project Results

The two special projects during the last week of class were well received (Fig. 20). One student commented, “Good idea! We actually applied our knowledge, so it gave the classes closure. Instead of a test we had a complicated project.” (survey #14) The motor design class especially received very strong positive reviews. Many students commented that they enjoyed the hands-on aspect of applying physics: “It was very satisfying to make something out of nothing – a definite must for next year!” (survey #11) There was some difficulty sharing the machines among so many people (we worked with a group of teachers as well), but all student evaluations were positive.

The robotic surgery class also received positive reviews, though about half of the students reported being tired by the end of the week, which made it hard to concentrate and get the most out of the project, and led to some friction between team members who wanted to work and those who were too tired. Nevertheless, nearly all students reported that the project was fun and they enjoyed putting their knowledge from the three weeks into practice.

“The surgery project was very cool! It was mostly a problem-solving exercise for me, and it was good because you realize that it’s sometimes the simpler, more basic solutions that work the best. If you complicate things too much, nothing works.” (survey #4)
The greatest difficulty of the special projects was that they were intensive, requiring special supplies, special instructors, and a great deal of energy from the students. However, it was that intensity that enabled the special projects to bring so much material together in the final week.

4.1.7 Residential results
Students were unanimously positive about the extracurricular activities we held, though one commented that less structure would have made them more relaxing. For one student, our nightly curfew was restrictive, whereas another liked the great freedom of being able to go anywhere without asking her parents first. Several students reported that the dormitory rooms were too small – some had only one desk and one chair – and many students wished for air conditioning during the heat and humidity. We experienced only minor residential problems with student discipline and health, and in all cases the TAs were very helpful in resolving the situations.

4.1.8 Overall Evaluation
Student and staff evaluations indicate that the 2002 program was an extremely successful pilot with no major trouble. Its success can reasonably be attributed to the diligence of the twelve staff members and the enthusiasm of its students:

"I enjoyed this program so much. It was so well-planned and thoughtful." (survey #5)

“It allowed us to work on things we normally wouldn't be able to do it school.”

(survey #11)

“I am definitely more informed for when I make my college decision. I also gained a ton of confidence in my abilities, my academics, and also how I will adjust to college life.”

(survey #17)

4.2 Recommendations for Improvement
4.2.1 Longer Duration
Increasing the length of the program from 4 to 6 weeks would improve the curriculum and make it easier to recruit the best staff members. Three weeks of class and one week on special projects was barely enough to cover the basics in each field. Additional time would allow the material to be covered in greater depth, potentially reaching more interesting topics. It was difficult this
year to hire staff for only four weeks in the middle of the summer, because that essentially prevented them from obtaining a full-time 10-week summer job that could have paid several times as much. Increasing the length of the program to make it essentially a full-summer job would help with the hiring process (Table 2). As an alternative to a longer program, two separate summer sessions could be run, one after another; however, my personal feeling is that it is easier for the staff to focus on a single session with one group of students, so I recommend a single 6-week session.

**Table 2.** Recommended timeline for 2003.

<table>
<thead>
<tr>
<th>September-January</th>
<th>Coordinate publicity and recruitment with MIT admissions office</th>
</tr>
</thead>
<tbody>
<tr>
<td>November 1</td>
<td>Publish student application</td>
</tr>
<tr>
<td>January – February</td>
<td>Recruit and hire staff</td>
</tr>
<tr>
<td>February 1</td>
<td>Applications due</td>
</tr>
<tr>
<td>February-March</td>
<td>Coordinate student selection with MIT admissions office</td>
</tr>
<tr>
<td>April 1</td>
<td>Admissions notification</td>
</tr>
<tr>
<td>June 16-20</td>
<td>Staff training</td>
</tr>
<tr>
<td>June 21</td>
<td>Students arrive</td>
</tr>
<tr>
<td>June 23-August 1</td>
<td>Six weeks of class</td>
</tr>
<tr>
<td>August 2</td>
<td>Students depart</td>
</tr>
</tbody>
</table>

**4.2.2 More Students**

Having more students participate would increase the total effect of the program. Additionally, it would reduce the negative effect on students who applied and were rejected due to lack of space. This year, there were over 100 students who were academically qualified and who we sincerely would have liked to accept if we had more space. I recommend scaling the program up from 27 to 40 students for 2003 with minimal changes from this year; a few more TAs would keep the student-to-staff ratio low (Fig. 21). Scaling up to 100 students would require significant organizational changes because it would be harder to maintain communication with a larger staff, and the class structure would have to be adapted to keep a reasonable load on both the instructors and students.

In future years I recommend expanding the program even more – the potential impact of a larger program is enormous. For example, MIT has approximately 300 undergraduate students in
EECS per year, of whom about 60 are female (1 in 5). A summer EECS recruitment program yielding another 60 undergraduate women per year could increase the gender ratio to 1 in 3.

### 4.2.3 Greater Socioeconomic Diversity

More should be done to encourage women from underrepresented ethnicities and poorer economic backgrounds. The easiest women to recruit into EECS will be those from more privileged backgrounds, but that fixes one problem at the cost of another. The MITE²S program for ethnic minorities and MIT is notable for also balancing its student gender ratio. WTP and similar programs for women should consider balancing their ethnic composition. This does not need to entail quotas or reverse-discrimination, but it is an issue that should be addressed rather than ignored. I recommend focusing on the recruitment stage, by coordinating with the MIT admissions office to locate and contact promising potential students who might be unaware of the program, and by contacting national organizations that promote underrepresented youth. Clarifying the admissions policy to explicitly take socioeconomic background into account could also increase the yield of disadvantaged students.

### 4.2.4 Simplified Staffing Structure

Fewer staff positions would be necessary if the staff were not all students. I recommend having a single director position in addition to the instructors and TAs. The college admissions office could help with recruitment and admissions, while the director could plan the residential life with the help of one Head TA with experience from the previous year (Fig. 22).

### 4.2.5 Academic Adjustments

I recommend shortening each class from two hours to one and a half (Fig. 23), based on student and staff reports that the day was long and fatiguing. This should help students stay focused while in class, and they can cover just as much material with up to an hour of homework for each class each night. I would have only one guest lecturer per week in order to keep the students more interested, and I would meet with each lecturer ahead of time to discuss the presentation. I recommend a single final project during the last week of class to provide a more unified conclusion than the two projects we did this year.
Figure 21. Recommended academic structure for 40 students.

Figure 22. Recommended residential staff structure for 40 students.

Figure 23. Recommended daily schedule.
4.3 Recommendations for Future Evaluation

WTP is primarily concerned with having a long-term impact on the current gender inequity. The positive evaluations from the first year confirm that there were no major problems, but ultimately a longer evaluation process is necessary to assess the program’s success. I recommend keeping in touch with the 2002 students in order to evaluate the impact this program had on their lives by the time they enter college, by the time they finish college, and when they move into a career.

Beyond mailing surveys, a good way to keep in touch with students would be to invite them back to participate as actively as possible in future WTP sessions. A start would be to invite them to the closing ceremonies, but even more involvement would be beneficial. On-line discussion forums or mailing lists, opportunities to work as WTP staff members in the future, and mentoring of future WTP students could all be beneficial and keep them involved.

4.4 Recommendations for Creating Similar Programs

There are three ingredients necessary to start a program like WTP at another university:

1) Funding

WTP cost over $4000 per student. A low-budget 4-week program might cut this down to $2500 each through reduced staff, cheaper university housing, and reduced food. Students could pay for all of their own food or pay the entire cost of the program, as is the case at many summer schools.

An expanded 6-week program for 40 students might cost $220,000, while a strictly budgeted 4-week 25-student program could be $80,000 (Tables 3 and 4).

2) Housing

MIT had a tight housing situation, and even with money it wasn’t certain that we would find housing. The best approach is to start as soon as money is available.

3) Staff

The instructors and TAs were critical to making the program run well. A longer, full-time summer program with corresponding salaries would make it easier to attract quality staff. Another incentive could be to offer some kind of university teaching credit. Strong recruitment through posters, email, and word of mouth is important in reaching potential staff.
It was easier to start this program at MIT because of the local environment and the national reputation. Locally, there was strong support for the program from students, faculty, and administrators. The official support of the EECS department worked wonders in opening doors and getting results. MIT’s national reputation for EECS also made student recruitment easier and suggested that funding would be unproblematic. A similar program at another university could choose to target the same national top-notch group of students or could focus more on local students or a group similar to the university’s undergraduate population.

**Table 3.** Possible expanded budget for 40 students, 6 weeks.

<table>
<thead>
<tr>
<th>Budget Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff</td>
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<td>Housing</td>
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<td>Food</td>
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<tr>
<td>Academics</td>
<td>$24,000</td>
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<tr>
<td>Recreation</td>
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<tr>
<td>Materials and Services</td>
<td>$7,000</td>
</tr>
<tr>
<td>Recruitment</td>
<td>$6,000</td>
</tr>
<tr>
<td>Travel Scholarships</td>
<td>$3,000</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$219,000</strong></td>
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**Table 4.** Possible minimal budget for 25 students, 4 weeks. Staff are paid less, university housing is cheaper, and students buy their own food.

<table>
<thead>
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<th>Budget Category</th>
<th>Amount</th>
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<tr>
<td>Staff</td>
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<tr>
<td>Housing</td>
<td>$16,000</td>
</tr>
<tr>
<td>Food</td>
<td>$2,000</td>
</tr>
<tr>
<td>Academics</td>
<td>$10,000</td>
</tr>
<tr>
<td>Recreation</td>
<td>$3,000</td>
</tr>
<tr>
<td>Materials and Services</td>
<td>$4,000</td>
</tr>
<tr>
<td>Recruitment</td>
<td>$2,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$78,000</strong></td>
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</tbody>
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5.0 Bibliography

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http://www-swiss.ai.mit.edu/~hal/women-enrollment-comm/final-report.html

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http://cisstweb.cs.jhu.edu/~cissrs/Activities/LEGOComp/overview.html


http://www-eecs.mit.edu/women-stu.html


http://student.mit.edu/searchiap/fs-6-911.html

http://www.udel.edu/PR/UpDate/01/18/computer.html

http://web.mit.edu/facts/enrollment.html

http://www-eecs.mit.edu/facts.html

http://www.ncrw.org/research/sciexec.htm


Women’s Technology Program Web Site. Accessed 2/15/02.
http://wtp.mit.edu/
## Appendix A. 2002 Calendar

<table>
<thead>
<tr>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
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<th>Saturday</th>
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<td>June 16</td>
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<td>Staff Training</td>
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<tr>
<td>23</td>
<td>Orientation</td>
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<tr>
<td></td>
<td>10am Intro &amp; Scav Hunt</td>
<td>1st day of class &amp; Crickets project</td>
<td>Talk: Speech Recognition</td>
<td>Talk: Machine Learning</td>
<td>Tour: Robot Lab</td>
<td>Tour: Semiconductor Fab</td>
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<tr>
<td>30</td>
<td>Camping Trip</td>
<td>July 1</td>
<td>2</td>
<td>3</td>
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<td>7</td>
<td>Beach Trip</td>
<td>8</td>
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<td>10</td>
<td>11</td>
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<tr>
<td></td>
<td></td>
<td>Talk: Artificial Evolution &amp; Bowling</td>
<td>Talk: College Admissions</td>
<td>MIT Museum</td>
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<td>14</td>
<td>Dim-Sum Harbor Islands</td>
<td>15</td>
<td>16</td>
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<td></td>
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<td>Motor Project</td>
<td>Motor Project</td>
<td>Motor Project</td>
<td>Surgery Project Talk: MamaMedia</td>
<td>Surgery Project 6pm Closing Banquet &amp; 10pm Talent show</td>
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<tr>
<td>22</td>
<td>Students Arrive Airport Shuttle</td>
<td>23</td>
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### Appendix B. 2002 Budget

<table>
<thead>
<tr>
<th>Salaries &amp; Wages</th>
<th>Total</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Graduate Instructors</td>
<td>$12,093</td>
<td>3 instructors</td>
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<tr>
<td>Undergraduate Tutors</td>
<td>$15,581</td>
<td>6 tutors</td>
</tr>
<tr>
<td>Residential Director</td>
<td>$2,884</td>
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<tr>
<td>Recruitment Director</td>
<td>$2,640</td>
<td>January-April</td>
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<tr>
<td>Program Director</td>
<td>$16,943</td>
<td>Full RA+tuition spring/sum</td>
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<tr>
<td><strong>Total Salaries &amp; Wages</strong></td>
<td><strong>$50,141</strong></td>
<td>* Includes bonuses</td>
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<table>
<thead>
<tr>
<th>Food</th>
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<tbody>
<tr>
<td>Meal Cards</td>
<td>$13,680</td>
<td></td>
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<tr>
<td>Final Banquet</td>
<td>$4,000</td>
<td>70 guests</td>
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<td>Orientation Food</td>
<td>$1,041</td>
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<tr>
<td>Sponsored Dinners</td>
<td>$1,631</td>
<td>GW6, SWE</td>
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<tr>
<td>Miscellaneous</td>
<td>$1,699</td>
<td>Bkfst, Camping, Classes</td>
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<tr>
<td><strong>Total Food</strong></td>
<td><strong>$22,051</strong></td>
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</tbody>
</table>

| Student Housing                  | $20,384|                                               |
| Staff Housing                    | $8,096 |                                               |
| **Academic Supplies**            | $15,753| Textbooks and lab kits                        |

<table>
<thead>
<tr>
<th>Extracurriculars</th>
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<tbody>
<tr>
<td>Athletic Cards</td>
<td>$1,050</td>
<td>$70 * 15 students</td>
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<tr>
<td>Scheduled Events</td>
<td>$3,610</td>
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<tr>
<td>TA-Run Events</td>
<td>$1,554</td>
<td>$10/wk per person</td>
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<tr>
<td><strong>Total Extracurriculars</strong></td>
<td><strong>$6,214</strong></td>
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<th>Materials and Services</th>
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<tbody>
<tr>
<td>Orientation Supplies</td>
<td>$445</td>
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<tr>
<td>Photography</td>
<td>$775</td>
<td>50 copies, pro photographer</td>
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<tr>
<td>Banquet Supplies</td>
<td>$635</td>
<td>Invitations, Flowers</td>
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<tr>
<td>T-shirts</td>
<td>$994</td>
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<tr>
<td>Telephone</td>
<td>$500</td>
<td>Office &amp; cells</td>
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<tr>
<td>Office Supplies</td>
<td>$500</td>
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<tr>
<td>Photocopies</td>
<td>$1,000</td>
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<tr>
<td><strong>Total Materials and Services</strong></td>
<td><strong>$4,849</strong></td>
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</tbody>
</table>

| Recruitment                      | $3,000 |                                               |
| Student Travel                   | $1,658 | 2 students                                    |
| Transportation                   | $1,328 |                                               |
| **TOTAL COSTS**                  | **$133,474**|                                               |

<table>
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<th>Income</th>
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<tbody>
<tr>
<td>Chancellor</td>
<td>$65,000</td>
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<tr>
<td>School of Engineering</td>
<td>$30,000</td>
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<tr>
<td>Student Fees</td>
<td>$22,600</td>
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<tr>
<td>EECS Department</td>
<td>$15,874</td>
<td>Flexible $5k - $20k</td>
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<tr>
<td><strong>TOTAL INCOME</strong></td>
<td><strong>$133,474</strong></td>
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</table>
Appendix C. Class Outlines

Computer Science

CS Week 1
June 24 (one hour class): Lecture 0. Introduction. Letter lottery: each student was assigned their letter, and an associated CS word. They had to find 3 interesting facts about their word, at least one of which had to do with the history. (See file letter_assignment.txt.) (1 hour)


June 26: Lecture 2. Review of problems from book (Ch 1: 1, 2, 4). Variables and Values. Objects and References. Variable assignment. More on writing and calling methods. (1 hour 40 minutes)

June 27: Problems from book: Ch 2: 1, 2(a), 3(a,d), 4; Ch 3: 5(b) (1 hour)


CS Week 2
July 1: Lecture 4. Review of previous week's topics. User Events and Event Handlers (45 minutes)

July 2: Project work

July 3: Project work. Show and tell (last hour of class). End of project 1.

July 4: Holiday

July 5: Lecture 5. Lists, conditionals and loops (2 hours). Start project 2.

CS Week 3
July 8: Lecture 6. Introduction to recognition (30 minutes).

July 9: Lecture 7 (first 1/2). More practice with lists, conditionals and loops. (1.5 hours)

July 10: Lecture 7. Inheritance (30 minutes)

July 11: Extreme programming (TA) (15 minutes)

July 12: Applets (TA) (10 minutes)
Mathematics

Math Week 1


June 28: Karnaugh maps: 2d, 3d, 4d, don’t cares. Logic in English, problems we encounter, in/exclusive OR. Implication, biconditional operators.

Math Week 2


Wednesday, July 3: Work day.

Thursday, July 4: Holiday, no class.

Friday, July 5: Proof by induction. Recognizing patterns in sequences.

Math Week 3
Monday, July 8: Graphy theory: definitions, examples. Intro to chromatic number.

Tuesday, July 9: Chromatic number/polynomial. Ramsey theory of coloring.


Electrical Engineering

I. Introduction to Electrical Engineering (Days 1 and 2)
   A. Electricity
      1. Current
      2. Voltage
   B. Circuits are used for power and information transfer
   C. Measurement methods

II. Components and circuits to illustrate each component’s function
   A. Resistors (Days 1 and 2)
   B. Voltage Sources (Days 1 and 2)
   C. Capacitors (Days 3 and 4)
   D. Inductors (just mentioned in lecture)
   E. Diodes (Days 5 and 6)
   F. Transistors (Days 7 and 8)

III. Building and analyzing an AM radio
   A. Building it and testing it in various locations (Day 9)
   B. Breaking radio down into smaller blocks and analyzing the input and output of each block (Days 10 and 11)
   C. Assigning one block to groups of two students and having the group teach the rest of class what the block does. (Days 11 and 12)

IV. Choosing and building a circuit from their 500in1 electronics kit (Days 13 and 14)
   A. Explaining to class how circuit works
   B. Showing class what circuit does