FOCUS

Technique • Friday, September 7, 2001

Awaiting the big game?
Ready to see some serious athleticism and sportsmanship? Ready yourself for FSU vs Tech and the true spirit of competition. **Next week**

Who let the nerds out?
Dragon*Con descends upon Atlanta in a magnificent display of goth, fantasy and science fiction. Read the commentary in Entertainment. **Page 26**

Georgia Tech's Greatest Bank

By Sriram Narasimhan
Contributing Writer

It is a nonprofit organization that belabors each day to finance an overwhelming portion of the Institute's resources. A great deal of the student body is unaware of its location on campus, and much less aware of what it actually does. But yet, even away from the spotlight, it is the driving force behind Tech's outstanding reputation, bringing to the school an image that one can often take for granted.

It is the Georgia Tech Foundation (GTF), a collective group of elected officers and volunteer trustees responsible for the fundraising, administration and allocation of donations that Tech receives from alumni, friends, students, faculty corporations and other foundations that are primarily located at private schools around the country. Without it, Tech would not have the financial resources to fund scholarships, finance the construction of new buildings and facilities and endow research projects, all of the necessary requirements for becoming a world-renowned university.

Georgia Tech is one of 34 schools currently supported by state funding under the University System of Georgia. Because Tech is a technical institution, however, it naturally demands greater resources for its research and laboratories than the other state schools.

Dr. Jean-Lou Chameau, Georgia Tech Provost, said, "We haven't seen evidence until recently that the state wanted Georgia Tech to be of national and international prominence. It has attained the reputation of being one of the top five [engineering] schools in the country by relying on outside funds which include donations." In addition, the school annually grants the President's Scholarship and the President's Fellowship to undergraduate and graduate students, respectively, as well as endowments to professors so that they can continue to perform research.

Although extremely supportive of Tech's goals for national recognition, the state of Georgia could only provide base funding to all its member schools, so Georgia Tech had to find some way of competing with the other private engineering schools across the nation. It was the Institute's hope that the scholarships and technologically superior research facilities would appeal to high-caliber students and maintain its tradition of excellence.

The natural response to this issue was the establishment of the Georgia Tech Foundation, whose central office is located on the south side of Bobby Dodd Stadium, in the Wardlaw Center. The President and Chief Operating Officer of the organization John Carter said, "the Foundation has assisted the administration by investing in programs such as laboratories and scholarships, because a technical education is much more difficult to provide" than other kinds of programs at Tech or the other state schools.

Currently, the state provides about 28 percent of the school's revenue, while students provide about 25 percent through tuition. The remainder consists of donations and some federal grants

*See **Foundation**, page 21*

How important is your GPA?

With the onslaught of grade padding and inflation in colleges today, GPA has lost is ability to indicate student potential. What does your GPA at Tech say about you?

By Shantan Pesaru
Contributing Writer

By Zack Kraus / STUDENT PUBLICATIONS

A student completes a request for readmission form after failing to meet minimum GPA requirements. Many students struggle under the academic rigors of maintaining a high GPA.

Do you remember significant digits from your high school chemistry class? Did you ever wonder why it was necessary to have five rules for rounding silly little numbers? Maybe you pondered the significance of stripping numbers of their calculator-friendly dignity. Regardless of your level of excitement for high school chemistry or for the rules of rounding, for that matter, silly little numbers constantly pervade our lives. At Tech, the silliest and most significant digit that will follow you wherever you go will probably be your Grade Point Average (GPA).

Given Tech's academic reputation, it is easy for students to underestimate the importance of maintaining their GPA. Since many students assume they will be recruited immediately upon graduation, especially given the hiring rush of the late 1990s, GPA is not always a top priority. Yet perhaps it should be.

You see, the Tech reputation may not always entice recruiters to hire students. This is particularly true during economic recessions and hiring freezes when competition for top-notch positions is razor sharp. With the job pool more concentrated with qualified applicants, higher GPAs differentiate competing job candidates.

In addition, a good GPA is required to retain the HOPE scholarship, to secure a co-op job or even to get a discount on car insurance. Either way you look at it, a high GPA matters.

Moreover, GPA is critical for graduates attempting to land that first serious job. Ralph Mobley, Director of Career Services, is well versed in the importance of maintaining a good GPA while in college.

"Recruiters look at GPA and look at it as a measuring stick of success," Mobley said. "It's a demonstration that you can be successful in the workplace."

Taking your GPA lightly could mean the difference between a plethora of offers from Fortune 500 firms and a fanatical search for a paycheck. It could also mean the difference between continued enrollment at Tech and standing in line at the Registrar's Office to fill out an application for readmission.

It is important to continually review your

*See **GPA**, page 22*

Campus Research Review
AI Engineering Computer Chips

By Benjamin Small
Columnist

By Daniel Uhlig / STUDENT PUBLICATIONS

Professor Gary May optimizes the fabrication of semiconductor components. He utilizes artificial neural networks in order to make this process as cost-effective as possible.

Everybody uses computer chips, every day, everywhere. But did you ever stop to think how these microelectronic miracles are actually made? Sure, we know they contain some "semiconductor"—whatever that is. But how is it that something so small can do so much so fast? And hundreds of billions of dollars are spent every year to try to make them even smaller, even faster and able to do even more.

As is this column's traditional approach to complex theories and methodologies, we'll start with some of the basics and leave the details to professional engineers and scientists. (Otherwise your Georgia Tech degree wouldn't be worth much.)

We all know about electricity; we know about Mr. Franklin's kite experiment and, if you paid attention in physics, about Messieurs Ampère, Tesla and Edison. We know electricity conducts through metals but not through rubber, *et cetera*, *et cetera*. But how does electricity allow us to check e-mail, watch movies, and order online the latest chinos at **jcrew.com**? More specifically, how does a computer chip actually work?

Like we said, some materials conduct electricity and some don't, but there is also a class of materials where we can control exactly how much is conducted. So, yeah, that's pretty cool. We call these materials "semiconductors;" some examples are silicon, gallium nitride, antimony telluride, and indium gallium arsenide phosphide. (The exact reason these are semiconductors involves a heap of physical chemistry, so we'll leave it as an exercise for the reader.) Turns out that the amount of electrical conductance can be modulated—that is, we can easily control how much electricity flows through a particular piece of semiconductor—*voilà*, a transistor. Transistors are crazy-übercool because they can do arithmetic for us; we can program arrays of them to do any number of amazingly complex tasks. This of course leaves our fingers free to do more exciting and stimulating things. Before I bore to death all of the electrical engineers, I'll skip ahead a bit.

The actual arrangement of all of these little pieces of transistor is actually really complicated. Modern devices are about one-tenth of a micron wide; that's really freakin' small—only a few hundred atoms. And we fit trillions of the little buggers onto a big, flat, shiny piece of silicon—a "wafer." These wafers are exposed to various chemical plasmas and have different metal films deposited on them; that's how we make transistors in bulk. We also pattern the surface to determine where tran-

*See **Research**, page 24*

Tech parking policies comparable to those of similar colleges

By Craig J. Davis
Contributing Writer

When asked to voice an opinion on parking, most Georgia Tech students whine or moan about the lack of spaces, the inconvenience of space allocation or the exorbitant cost of obtaining a parking pass at all.

However, the problem is not as bad as generally thought. Most first-time applicants that apply early are more than likely to get a space, since assignments for first-time applicants are made in the order they are received.

In addition, the price of parking might seem outrageous to some, but considering the urban setting of Tech, it is more than reasonable. Parking on campus can be at least $350 cheaper than commercial decks or lots for the entire academic year (August through May). Most students don't realize they can save in excess of 50 percent. Parking at Chicago's Northwestern University, for example, first requires administrative approval and may cost as much $730.

At present, the cost of parking at Tech for one academic year ranges from $275 to $450 according to lot location. In the future, however, all spaces will be $500, regardless of location.

"When comparing the number of students that request a space to the number of spaces, we're really average when compared to other schools in an urban setting like Atlanta," said Rod Weis, Director of Parking and Transportation Services at Georgia Tech.

Overselling causes problems for some Tech students. Depending on the type of lot (commuters, students, employees), Tech's rate of overselling can range anywhere from zero to 65 percent.

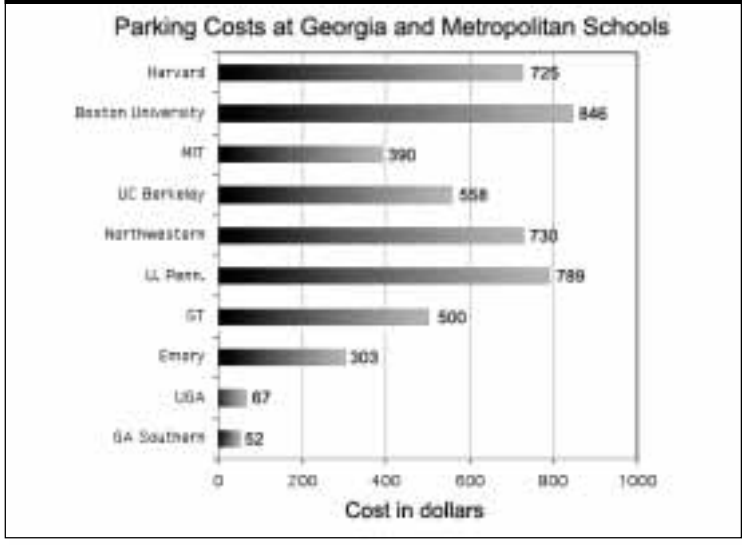
Over at Emory University, just east of downtown, the situation is different. There, every student that requests a space gets one. However, they must apply early, since assignments are made by computer on a first-come, first-served basis. Student parking at Emory is $321 per academic year for decks or various dormitory lots.

As is the case for Tech freshmen, Emory students in their freshman year are not able to apply for parking. Like many of the complaints at Tech, the majority of student dissatisfaction comes from spaces allocated in undesired areas, far from where the student lives or attends class. Also, unlike Tech, not all spaces are filled, which results in a zero percent oversell for Emory students.

"The fees at Emory are reasonable and the transportation and security services here are adequate and everyone who requests a space receives one. We try our best to accommodate everyone," said Yolanda Rhoden, a dispatcher for the Emory University Parking Office.

At the University of Georgia, the situation is similar to Emory's. The number of spaces is sufficient, but again, the location of the spaces is the most common complaint. The price for a permit at UGA is $47 for commuters, $200 for deck parking and $67 for resident or graduate parking. UGA's biggest parking problem comes at the beginning of the year, when students are still finding their daily routines. The biggest advantage that UGA has is that it allows freshmen to park for their first semester, something that Emory and Tech cannot offer.

Infographic: Expense



"In a society that's becoming increasingly dependent on vehicles, there's usually a shock when students come to school expecting the same situation as they had at home, and they come to an area that's more pedestrian oriented," said Jennifer Tougas, Ph.D., the Assistant Manager of Parking Services at the University of Georgia.

Down in Statesboro, Georgia, at Georgia Southern University, students are better off than any of the aforementioned schools. Parking is only $52 for the entire year, and there is no restriction on freshmen parking.

The biggest source of complaints from Georgia Southern students is that there are no spaces available in commuter lots. However, since there

*See **Parking**, page 19*

Ticket received

Upon receipt of a parking citation, students may either make payment or appeal to Student Parking Appeals Board within two weeks of issuance of the ticket.

Appeal submitted

In order to appeal a ticket, students have two options. One is to pick up an appeal form from the Parking Office, complete it, and return it to the office. Also, appeals may be submitted online at the Parking & Transportation Services home page.

Parking from page 18

is no shortage of parking, students just simply park further away from campus. Georgia Southern does have one drawback though: no shuttle services. This is because it only takes 15 minutes to walk across campus, only a fraction of the time at larger schools. Also, since Statesboro is a more modern college town, commercial apartments are easily located across the street from campus.

Recently, Georgia Southern has seen an increase in permit applications with little to no change in student enrollment. "Now that students have the HOPE Scholarship, they are spending the money they would have spent on tuition on cars," said Joanie Greenlees, Enforcement Supervisor of Parking and Transportation at Georgia Southern University.

Fortunately, most students overlook the parking problem at Tech and chose to focus on their education instead. Hopefully in the future the parking situation will not be so bad, but for now, Tech students will just have to do what they do best, adapt.

*The Parking Office can be found online at **www.parking.gatech.edu***

Word to the Wise

Wanna Drive?

Perhaps Marta wasn't such a bad idea afterall

Fees	
B01, B02	$ 450.00
B03, B04, B05, B06, B07	$425. 00
All A and R Lots	$ 340.00
P01	$ 275.00
Evening/Weekend	$ 120.00
Motorcycle	$ 50.00
Reserved Space	$ 625.00
Reserved Space*	$625
Lost gate card	$10
Lost Buzz Card	$18
Effective August 1, 2001 - July 31, 2002	

After certain dates of the year, fees will be on a pro rata basis

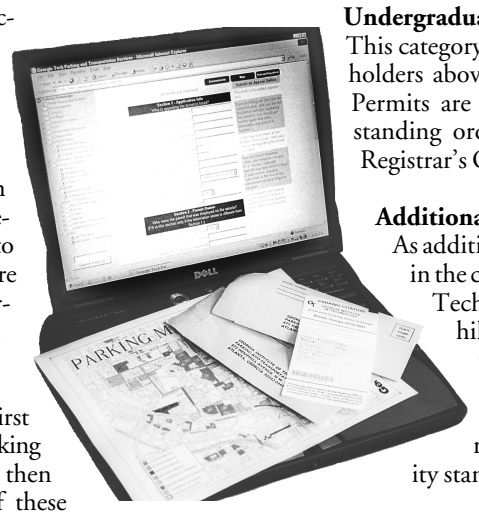
Parking Permit Priorities

Parking space at Georgia Tech is limited, and permits are a scarce resource. Applicants are categorized into specific priority groups for permit distribution.

Current permit holders
Those who already own permits (faculty, staff and students) and request to be assigned to the same zone are given *highest priority*.

Faculty and staff
Employees of Georgia Tech are given second priority. Within this category, permit holders requesting to be assigned to a different zone are give higher priority over non-permit holders requesting a new spot.

Graduate students
As with the faculty and staff, the first in this category are permit holders seeking to be assigned to a new zone, and then non-permit holders. In both of these subcategories, research and teaching assistants are given higher priority than others. Further permits are given in order of current class standing (senior, junior, sophomore, freshman), as reported by the Registrar's Office Records.



Undergraduate students
This category also prioritizes permit holders above non-permit holders. Permits are given in current class standing order, as determined by Registrar's Office Records.

Additional Parking Permits
As additional spaces open up, as in the case of the new spots on Tech Parkway and Hemphill, students currently on the waiting list are allotted parking passes according to their already determined priority standing.

All applicants applying for permits after the June 15th deadline
All permit requests received after June 15th are placed in a separate, lower priority group. THis is the lowest priority group.

Each of the following categories require that the application be received by June 15th. Groups are listed in descending order of priority.

Appellant notified of outcome
The board may close a case by one of the following decisions:
i. Upholding current charges
ii. Upholding charges, but reducing the fine
iii. Reducing charges to a lesser offense
iv. Dismissing charges.

Second appeals
Faculty and staff members may make a second appeal, but must make such appeals in person. Faculty and staff appeals are made with the Faculty/Staff Parking Appeals Board.

Does student opinion count? Know about your rights

By Kimberly Rieck
Contributing Writer

Do students feel like their opinions are important to the administration? Does the administration respond to students' concerns? Are there policies in place to allow for the student voice to be heard?

These are all important questions that both the student body and the administration strive to answer. Students often do not know about or understand their rights and the appropriate sequence of procedures may seem daunting.

Students find if difficult to deal with legal matters on campus such as academic grievances, parking tickets, or charges of nonacademic misconduct. Students sometimes feel that the administration does not help them with these matters at all. "It seems to me that the administration doesn't give a damn at all," HTS major Paul Rogers said.

However, the administration is making improvements to the student appeals processes. The use of the Internet can alleviate some of the confusion that comes with trying to understand the procedures and policies at Georgia Tech. Policy, itself, has also been improved.

In cases where instructors have acted unfairly or improperly in the assignment of grades, students have the opportunity to appeal. The first step is to attempt to resolve the grievance with the individual faculty member or department involved.

If a student cannot come to a resolution with the professor, the next step is to request a formal hearing in writing. The letter should state the complaint and the remedy sought from the school or department. During the hearing, a committee consisting of four members, one of which is a faculty member who the student gets to choose, will review all the merits of the complaint and all the evidence. However, if a student is still unsatisfied with the results of the hearing, there is one last option available.

The last step is to appeal the decision to the Student Grievance and Appeal Committee. The letter should state the basis for the grievance, the facts that support it, a summary of the steps that have already been taken, the reasons why the student feels the resolutions that have been determined thus far are unfair or unsatisfactory and a statement of the desired result. There are a number of possibilities that can take place during the last stage of the appeal process. The committee may deny the appeal or decide to hold a formal hearing; the decision will be made within 30 days. If there is a hearing, the committee will make a decision within 30 days of receiving the testimony and any relevant documents.

Another problem that students often encounter is parking. There are a limited amount of parking spaces on campus, so often students will park in a spot and not realize that they have parked illegally.

"I want to go to law school because I've gotten the shaft so many times by the [parking office] when it comes to tickets and I know there has to be a reason why they can do this," IE major John Curtis Osmundsen said. The parking office tries to help students avoid parking illegally by posting signs and sending out letters warning students when certain areas are restricted for events such as football games. Also all holders of parking permits receive a map detailing where they can legally park.

However, if you do unjustly receive a parking ticket, you can appeal within two weeks. There are two options for appealing. One, go to the Parking office to pick up an appeal form, complete, and turn it in. If the first option is not convenient because of classes or time constraints, the Parking Office has made the form available online at **www.parking.gatech.edu**.

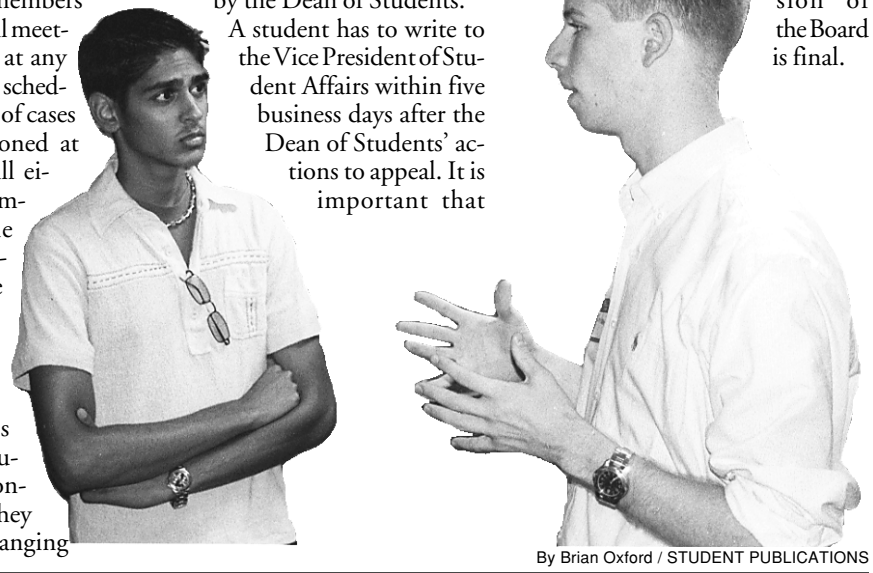
For students, the Student Parking Appeals Board receives and hears all student appeals. They meet at least semi-weekly on a regularly scheduled basis. Three members constitute a quorum for all meetings, with a limit of five at any one meeting. Hearings are scheduled for the presentation of cases and students are questioned at this time. The board will either uphold the charges completely, reduce the fine because of extenuating circumstances or dismiss the case altogether. Decisions will be given in writing to the appellant.

Another situation that, unfortunately, happens quite frequently is that students are charged with nonacademic misconduct; they are accused of anything ranging from violation of the Code of Conduct to theft. Students can either have the Dean of Students make a full disposition of the case or to take their case to the Undergraduate Judiciary Cabinet. Cases that result in expulsion or suspension are exceptions and will normally be referred to the UJC. Sara Cames, Chief Justice of the UJC, said that many times students choose to take their case to the UJC because they feel that their particular violation would be heard more fairly by a group of their peers.

Once the UJC hears a case, the hearing body will send a brief written summary with recommendations of the appropriate disciplinary action to the Dean of Students and to the student involved. The Dean of Students will then decide whether or not to accept the UJC's recommendation. Students have the right to appeal any decision made by the Dean of Students.

A student has to write to the Vice President of Student Affairs within five business days after the Dean of Students' actions to appeal. It is important that the letter contains all reasons why the student is dissatisfied with the decision. The Vice President of Student Affairs will then refer the appeal to the Student Grievance and Appeal Committee who will review all the facts. After the Vice President of Student Affairs considers the report, a final decision is made.

In extreme cases when the student is expelled, there is one last option—applying to the Board of Regents for a review of the decision. Students must submit an application to the Executive Secretary of the Board within 20 days after the Vice President's decision. If the Board does decide to grant the application, then the Board will investigate the decision within 60 days from the time that the student filed the application. The decision of the Board is final.



By Brian Oxford / STUDENT PUBLICATIONS

By Brian Oxford / STUDENT PUBLICATIONS

Students sign up for different committees at the Student Government Association open house. SGA provides a great forum for students to become actively involved at Georgia Tech.

Foundation

from page 17

that are administered by the Foundation. GTF requires that donations be used for academics and education, whether for the construction of new facilities, or for the institution of new scholarships. Athletic donations, on the other hand, are administered by another organization altogether, the Alexander Tharp Fund, overseen by the Georgia Tech Athletic Association.

While the Foundation is considered the custodian of these funds, which currently total nearly $900 million dollars, where those funds are to be allocated is primarily at the donor's discretion. Carter said, "we have a fiduciary responsibility to the donors to make sure the investments are used appropriately."

If the donor does not specify a department or major, the president and administrative advisors assume responsibility. "We are a bank, whose sole customer is Georgia Tech. We put the money to work; they invest it in the students…Our job is to assist the administration [in order] to provide that," The Vice Chairman of the Foundation, and retired President of Stith Equipment Company, H. Hammond Stith, said. If the funds in question are scholarships, fellowships or endowments, the administration will also have the final word on who specifically receives the money. Funds are also regularly allocated to programs such as FASET (Freshman Orientation) and for other small projects, such as the cost of bringing professors to Tech who wish to apply for teaching positions.

It's hard to miss the construction that takes place almost perennially on campus. The Foundation has invested time and money into buying available land in Atlanta and allocating it until it's needed for a particular project. A major aspect of Georgia Tech Foundation's fiscal policy this year is what it calls, "the magic of leverage," in which approximately $850 million of the available assets are leveraged for the construction of a number of facilities, including SAC II and Technology Square, an eight-acre multi-building complex on Fifth Street which will encapsulate a new College of Management, the Global Learning Center and a new center for executive education. Construction for the Technology Square project commenced Thursday. Other areas of construction are underway.

Although $850 million are being leveraged, it is important to remember that these assets are not actually being given away. The money will be returned to the Foundation over a period of the next thirty years. The reason for borrowing the money in the first place is that it provides the campus a pool of immediately available funds.

Students may recall that last year GT asked the Board of Regents for an increase in tuition (This was no reflection upon the performance of the Foundation). Even with the tuition increase, Georgia Tech remains well below the top ten engineering schools in terms of cost, excluding rooming and board.

GTF has built an impressive record over the years, and it has exceeded its goal of raising $300 million by over $400 million. In reference to possible areas of improvement that the Foundation could have made this past year, Stith said, "I think it would be very difficult to improve after an 18.6 percent return on investments prior to 2000. It would be very difficult to improve on a campaign that raised $714 million, which started with a goal of $300 million. It would be difficult to expand land and the amount of expanded buildings. We have no regrets."

GPA

from page 17

GPA. Based on your grade year, there are minimal requirements for term and overall GPA in order to be a student in good academic standing.

When using the above formula to calculate your GPA, it is very important to follow these guidelines:

1) You cannot accurately calculate GPA by figuring GPA for every term and then averaging all those numbers; you must calculate all credit hours at one time. 2) Pass/Fail hours are not taken into account for calculating GPA; incomplete or "W" grades are also neglected. 3) All letter grade basis courses are accounted for in your GPA.

This semester, Tech is taking steps to help students become more aware of their academic standing by introducing Midterm Grade Reports for 1000- and 2000-level courses. Midterm Grade Reports give students a heads-up on their academic performance in the middle of the semester so that they still have an opportunity to pull up their grades in the course.

Grade reports will be listed on OSCAR with markings of satisfactory (S) or unsatisfactory (U), unsatisfactory being a letter grade of "D" or lower.

Debbie Williamson, Associate Registrar, stresses the importance of Midterm Grade Reports for freshmen.

"[Midterm Grade Reports] will give students an indication of problems while they still have time to rectify the situation," Williamson said. Williamson also suggested that it is important for students to talk with instructors or TAs if they are having problems.

Students often have a bad semester their freshman year. Adjusting to the new social climate, developing effective study habits and managing the stress load is difficult for almost all entering freshmen. But students shouldn't fret. Instead, try to grow from the experience and use it towards your advantage. Employers like to see students who can bounce back from problems. Raising your GPA over time also demonstrates maturation and a committed effort to improvement. No one is perfect and employers tend to understand this.

> "Recruiters look at GPA as a measuring stick of success. It's a demonstration that you can be successful in the workplace."
>
> **Ralph Mobley**
> Director of Career Services

If you are continuously struggling with a low GPA, other alternatives are available. Students should get as much work experience related to their field as possible. Take advantage of the Co-op Program if your GPA is a 2.00 or higher and earn exceptional performance reviews from your employer. Aggressively seek opportunities to differentiate yourself from other employees and make a good impression. Sometimes work experience is as important to employers as GPA.

If you are not eligible for the Co-op Program, internships are available. Work experience and ethic will help any student secure a job upon graduation.

For those students who do not have problems maintaining good academic standing, it is still advantageous to have an extra edge when beginning the job search. Career Services' main goal is to help students gain that edge through its numerous programs. Visit their website at www.career.gatech.edu for tips on resume building, business etiquette, and interviewing.

GPA is certainly not the only determinate for selecting potential employees. Most employers recognize that Georgia Tech does not practice grade padding or grade inflation and therefore has a generally lower GPA Institute-wide. Many employers offset Tech students' GPAs accordingly.

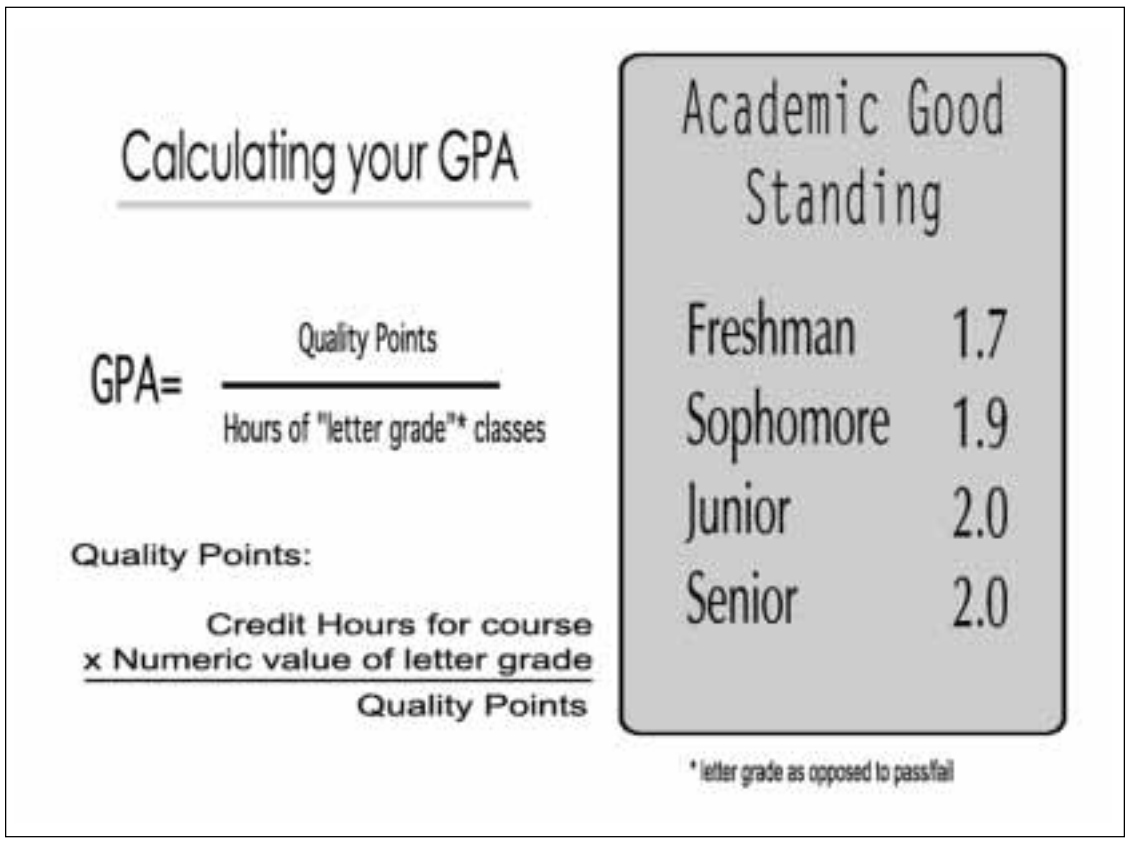
This is important because when a university practices grade inflation, it makes it very difficult for employers to make distinctions between students at the very top of the GPA pool. Therefore, college degrees, which derive their value from the information they carry, become less valuable for schools who inflate their students grades. In this respect, a Georgia Tech degree has more value than degrees from other well-known universities.

This is perhaps the most important reason why a good GPA should be maintained at Tech. At Tech, GPA is a better indicator of the caliber of student than at other colleges. Employers can separate the truly exceptional from the average and a students GPA can be very representative of student distinction. In addition, Tech's rigorous academic program is infamous in most industries and a high GPA serves as an indicator of a students hard work, commitment and determination.

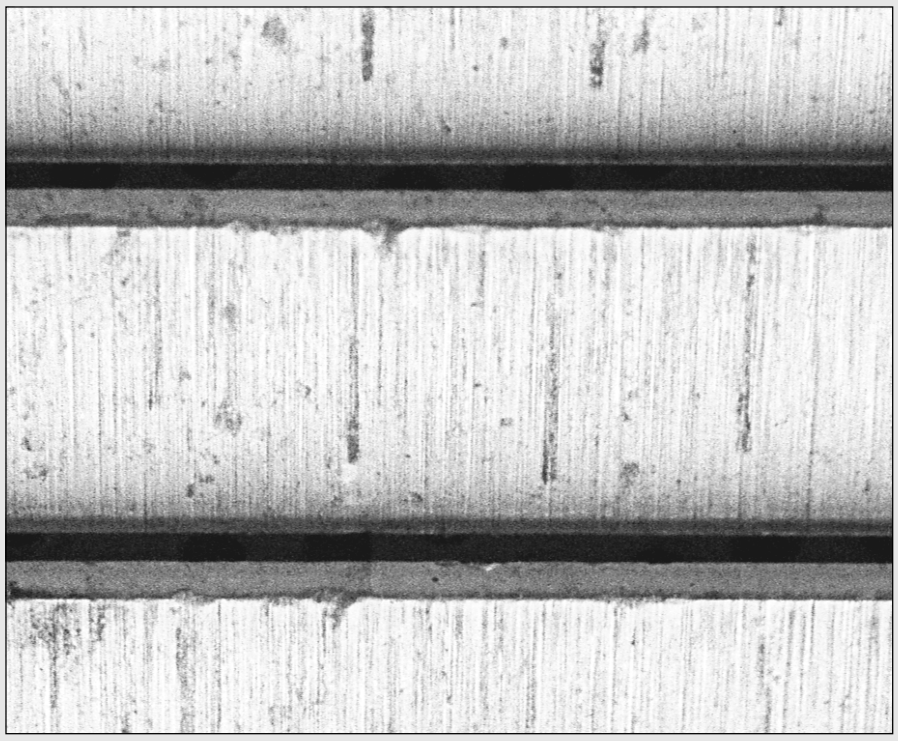
> "[Midterm Grade Reports] will give students an indication of problems while they still have time to rectify the situation."
>
> **Debbie Williamson**
> Associate Registrar

So students should remember that even though GPA sometimes appears to be a silly little three-digit number, it is quite significant to many employers and particularly so when combined with Tech's academic reputation.

*For more information read the rules and regulations section in the back of the general catalog or visit the Registrar's informational website at **www.registrar.gatech.edu**. If you have any questions about your academic record or GPA, you may contact the Registrar office by emailing them at **comments@registrar.gatech.edu.***



Tech UP Close



How well do you know Tech campus? Can you guess what the image is? Tech Up Close is an up close photo of an object on Tech campus. You might be leaning on it right now! Be the first person to e-mail **focus@technique.gatech.edu** with the correct answer and win a prize (plus the respect of all your peers).

By Daniel Uhlig / STUDENT PUBLICATIONS

Research from page 17

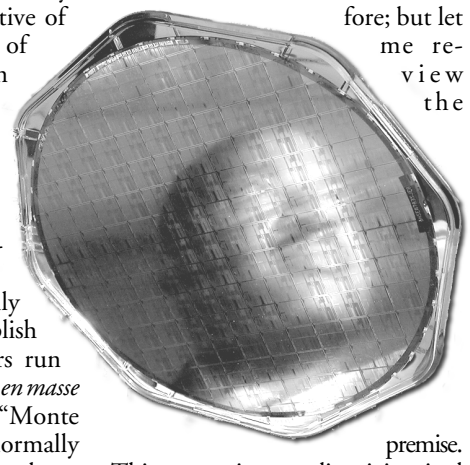
sistors and "interconnects" (just a fancy word for "wires") go with a light-sensitive liquid polymer; this process is called "photolithography" and is very similar to artistic lithography.

Anyway, so that's what big foundries like IBM, AMD, and Intel do: they push buckets of wafers around through all these different processes—there can be as many as a hundred separate steps—and then cut the wafer into little "chips," solder wires to them, and sell them to us as Thunderbirds, Pentium LXIX or whatever.

Clearly the whole procedure is really darn complicated; companies spend billions of dollars in making the facilities to house their operations. And every single step has to be optimized (or should be, anyway). That's where professor Gary May of the School of Electrical and Computer Engineering and his Intelligent Semiconductor Manufacturing group come in. There are thousands and thousands of individual parameters that affect the fabrication of a computer chip, between all the plasma etching, the deposition of insulating layers, the metalization and so on. Dr. May's research groups tries to tackle some of these variables to make the process as efficient and as robust as possible. Says professor May, "the objective of our research is to make use of the latest developments in computer hardware and software technology—namely, computer-integrated manufacturing to optimize the cost-effectiveness of [computer chip] manufacturing."

And they use some really clever techniques to accomplish this. Normally, researchers run huge "divide-and-conquer" *en masse* computer programs called "Monte Carlo" simulations; these normally take quite a long time to complete a full analysis of the problem. Professor May and his students, however, employ much more sophisticated techniques to characterize steps in the fabrication process. They use a program called the "Object-Oriented Neural Network Simulator" or "ObOrNNS." This is a C and C++ package that simulates very effectively a neural network; it is currently being ported to Java, of course.

You've probably heard of "neural networks" before; but let me review the premise.



This computing paradigm is inspired by the human neural system. Neural networks are composed of an extremely large number of highly interconnected processes which are executed in parallel. So these systems are generally very good at pattern matching, much like their human prototypes.

The Intelligent Semiconductor Manufacturing group uses software based on these heuristics in order to find trends in parameter variation on the process outcome. The most common alternative is to use those big, nasty "Monte Carlo" simulations instead; this is what's most popular, but professor May's group tends to have an easier time finding patterns with their artificial neural networks than the competition using bulkier algorithms. With their technologies, the group could, for example, attempt to determine the effects of process temperature on transistor yield. And the machinery used to do the analysis is actually part of the production setup—it's computer-integrated manufacturing.

The ultimate goal is to "minimize variation"—that is, to make each individual device as much like the others as possible. Controlling variation makes the computer chip fabrication process more cost-effective. This is a big deal, as Dr. May notes, "the expense of fabricating integrated circuits and related devices, already extreme, is becoming unbelievable…a typical state-of-the-art high-volume manufacturing facility today costs over 1000 times as much as it would have cost 20 years ago." And everybody wants to be cost-effective; everyone wants to make more money (especially Intel). And on billions of dollars, that can be a really big deal. Computer-integrated manufacturing with artificial neural networks—it's a good thing.

If microelectronic fabrication (making computer chips) is a field you might fancy, the Microelectronics Research Center is a good place to get started; numerous electrical and chemical engineering professors have really cool projects, and there's even a fabrication facility in the basement. If you find this specific idea of computer-integrated manufacturing with neural networks systems particularly fascinating, please contact professor May at **gmay@ece.gatech.edu**.