Course Descriptions
(Compiled from Previous Freshman Classes)

In response to comments from a previous freshmen class, that there were not enough useful details in the CMU Undergraduate Catalog for choosing courses, I have been collecting short course descriptions from SCS students for a few years. The descriptions vary in age: the newest were written in the spring, while the oldest may be a few years old. Where possible, I have provided descriptions from two different students for each course. Please be aware that …

- …each description is written solely from one student's point of view.
- …the student writing the description may have enjoyed or hated the class. The student may have earned an A, or a C, or failed the class. I asked students to try to present the facts in an interesting (although somewhat stereotypical) manner and to avoid "political" statements.
- …each description is a snapshot of a course as it was taught from a previous academic year. There is no guarantee that the course will be taught in the same manner. Different faculty members teach these courses in different ways; even the same instructor may experiment from semester to semester.

I have listed the courses in order, by their CMU numbers. Even if you aren't planning on taking many of these courses, reading these descriptions provides insight into how course are run at CMU and how students perceive them.

A special thanks to the students whose names appear at the end of each description for taking the time to write them. You will get a chance to add to this collection at the end of your freshman year.

03-121: (Biology) Modern Biology

Modern Biology is the general introductory biology course. The first part of the course covers basic biochemistry including types of bonds and the structure of biological molecules. The second part of the course focuses on the processes and mechanisms that go on in the cell. This includes cell structure, genetics, signaling, and the metabolic pathways. A couple of the people taking this course have already taken the AP and know the basics, but from a different perspective. Instead of giving a broad overview of different branches of biology, it starts over at the level of the cell to give you a deeper understanding. Lectures move quickly and cover a lot of material. There is a book that accompanies the course, but material tested only comes from the lecture. Purchasing the book is recommended to look up some of the more complicated concepts or make up for a missed lecture. Although there is no recitation, many students attend organized supplemental instruction sessions to go over more concrete examples of concepts taught in lecture. In terms of work assigned, there are a few online exercises, but nothing substantial. The bulk of the workload comes from studying for short in-class quizzes given weekly. They are not weighted heavily, but it is important to keep with material. Each concept uses or builds on the previous concept so it is easy to get behind. To learn enough to do well on the quizzes, about three hours of studying and supplemental instruction is needed. If you're behind, it's going to be more. Unlike the quizzes, the exams require more than a couple words or calculations. You need to be able to recall the processes and concepts illustrated in lecture fairly quickly. Furthermore, you need to be comfortable enough with the material to make connections between different units and apply the information to different situations. To get above a 90% on an exam, you need to know everything completely and have good test-taking skills. Luckily, there is almost always a hefty curve. Although the weekly workload is fairly low, studying for a modern biology exam takes a long time and a lot of work depending on the student. Despite the courses technical nature and large lecture setting, the student/teacher relationship is usually very good. The fall instructor, Dr. Brown, recently won the Doherty Award which is a prestigious teaching award at Carnegie Mellon.

Andreas Pfenning Class of 2006 (written April 2004)

This course in an intro to biology and is needed for most higher level biology courses. My year it was taught by Prof. Brown who really knows the material. The topics are from a wide range, and go in depth, but is not too overwhelming. The material is all learned in lectures, so attending class is a MUST. You can use the book but the lecture notes from class are sufficient on their own. Also, Doc. Brown does a great job of explaining so again, attending lecture is key. There are no homework assignments (wait I lied, there are like two total all year and they took about 10 minutes each so they don't count) and there is a weekly quiz, but 4/5 of them were online using blackboard, which makes it easy to take quizzes in your own time and place. The class is curved at the end, and was based on three tests and a comprehensive final. So there wasn't much work weekly, besides going to class (3 one hour lectures) and weekly quiz (1 hour). For the exams, review sessions are offered, and for the entire course, tutoring and supplemental instruction sessions are offered, so help is readily available. This is a great course if you are interested in bio/chem and would like to see how CMU approaches these subjects.

Sana Yousuf Class of 2007 (written April 2004)

03-130: (Biology) Biology of Organisms

This class would have to be one of my favorites while at CMU so far. It is only offered in the spring (so take 03-121 in the fall because that is a prereq) and was taught by an amazing teacher, Dr. Burket. The course really should be named Human Physiology and the topics include all of the body systems, their functions, components, and how they all work together. This is very interesting, especially if you like to figure out how things work together and build up to create complex objects (such as the body.) This course is not just a memorizing facts one, but also stimulates thought, as we talk about diseases, clinical patterns, and topics that concern us in everyday life. The key to getting an A in this course is attending lecture and taking good notes from the Professors lecture. Material is learned entirely through lecture, there are no homework assignments, but there is a weekly quiz each Tuesday at the beginning of class. The total amount of work per week was about 1 hour (studying for the quiz.) The teacher also offered extra credit, by means of attending guest lectures on campus and then writing short summaries (very easy.) So the final grade is determined by 10 quizzes, 3 100 point tests, and a 50 point final. The Professor does curve at the end of the year but as long as you attend class and take good notes, it is very easy to do well in the class.

Sana Yousuf Class of 2007 (written April 2004)

09-105: (Chemistry) Introduction to Modern Chemistry

Meets in a one hour lecture MWF, and a one hour recitation usually in the evening on Tuesday and Thursday. The lecture slides for this class were posted online as well as past exams and answer keys. You should attend class and not attempt to teach yourself from the slides because a large majority of the things tested on are not very well explained in the slides and during class on random days there are micro quizzes which are worth 2 points and used to make sure you are following along with lecture. It is easiest to print out the lecture slides and take additional notes on them, otherwise it is more difficult to follow as there is a lot of information. The course covers principles of atomic structure, chemical bonding, intermolecular interactions and molecular structures of organic and inorganic compounds including some transition metal complexes. It is not like most High School chemistry courses in that it focuses greatly on orbitals and how atoms "fit" together in bonding.!

Therefore you should not blow off this course because you did well in chemistry in High School. It is a relatively easy course if you actually take time to do the work and pay attention during lecture and recitation. About every week there will be a homework set of 4-5 problems, sometimes taken from the book sometimes created by the professor. These normally

take about an hour if you took your time. This is the only physical outside work they give you; the rest is studying for quizzes and tests. There is a 10 point quiz in recitation every week to two weeks. If you attended lecture and looked over past quizzes they are fairly straightforward. Quizzes are returned the following lecture. Tests are given during lecture and are returned during lecture, usually the next one. Tests are worth 100 points. The final is only the length of a normal test and was not cumulative. You were also allowed to retest on one of the previous tests to improve your score. Your final grade was determined by your total points then curved depending on how well the rest of the class had done. Suggestions when taking this class: read the chapters in the book, it is not assigned but it helps immensely, and go to SI sessions they give great study guides.

Maryanne Dellasall Class of 2009 (written June 2006)

==========

The class covers essentially the same material as a high school AP Chemistry course. The course begins with the fundamental principles of chemistry including standard measurements; the nature of atoms, molecules and ions; and stoichiometric calculations and equations. The class then moves on to the Ideal Gas Law, thermochemistry, quantum theory and light, electron configurations, and bonding. The material is wrapped up with discussions of molecular geometry and orbital theory, phase transitions, and properties of solutions.

09-105 consists of a Monday/Wednesday/Friday one-hour lecture and a Tuesday/Thursday hour-long recitation. Lectures include demonstrations of the ideas covered by the textbook: chemical reactions, explosions, diagrams, balloon representations of molecules, and the like. The professor also offers some insight into the history behind the discoveries presented in the book and their importance to the field of chemistry. The recitation instructor typically goes over homework solutions and answers students' questions.

The amount of homework assigned weekly ranges from about two to four hours. Homework consists of reading the textbook chapter (about one per week) and doing about a dozen assigned problems from the book. There is a quiz approximately every ten days, covering only that week's chapter. "Homework" might also include appropriate time to study for this quiz, though reading the chapter and lecture notes once is probably enough for most students.

Students' grades are derived from their quiz and homework scores. There are ten quizzes of 100 points each and ten corresponding homework assignments of 20 points each. The final exam is optional. It's broken up into ten sections matching the ten quizzes. A student may walk into the final exam and take any section(s) he or she wishes, substituting the grade for their original quiz grade (if it's higher). Essentially, students have two chances to score well on each quiz.

85% of the total points is the baseline for an A, 70% for B, and 55% for C. Only the raw score is considered; points are not weighted. The final grade may be curved (up only) if the class average is below a certain value, but this is unlikely to occur**.**

Jason Economou Class of 2008 (written May 2005)

09-217: (Chemistry) Organic Chemistry I

Organic Chemistry I covers reactions of organic compounds (alkanes, cycloalkanes, alkenes, alkynes, alcohols, and ethers), the mechanisms of those reactions, nomenclature, nucleophilic substitution, beta-elimination, stereochemistry, conformational analysis, spectroscopy, and synthesis of complex organic compounds. All new material is taught in lecture while recitations are used to reinforce and review important topics. A group problem is given in the second half of recitation. There are three exams during the semester (100 points each), 9 weekly problem sets (20), 10 group problems (10), and the final exam (200). The lowest exam (excluding the final), lowest two problem sets and lowest two group problems are dropped from the calculation of the final grade. There will be a curve depending on the performance of the class. Time is rarely an issue during the exams, and you are allowed to start 15 minutes earlier (8:15 instead of 8:30). To do the reading, homework, and some amount of studying takes about 5-6 hours each week outside of the 3 hours of lectures and 1 hour of recitation. Besides the graded homework, the instructor also provides suggested problems from the textbook, which are invaluable in understanding the material and preparing for the exams. Before each exam, the Teaching Assistants give a comprehensive review session outside of lecture. In addition, there are many resources provided by Academic Development: Supplemental Instruction (SI) which is an extra review session of the material covered the week before, and Peer Tutoring on Thursdays that provide one-on-one instruction.

Derek Leung Class of 2006 (written May 2002)

15-100: (Computer Science) Introductory/Intermediate Java Programming

15-100 is a programming class teaches Java. It is aimed for students with NO PROGRAMMING EXPERIENCE. If you have seen a if-statement, a loop or array, you can skip this course and go to 15-200. In this course, you will learn how to think in a logical way for programming. If-else-statements, for-loops, while-loops and arrays. By the end of the course, you will learn a bit about inheritance as well. Workload for this course is not that heavy. You will roughly get one lab assignment per week. The time it takes varies from one to four hours depending on the difficulties. Prof will probably read your code and give grades based on partial credits you get on each part. But if you get the programs running as expected, you are likely to get a very high score, maybe 1-2 points deducted for having inefficient codes. There will be 3-4 exams and one final. They are pretty easy and straight forward, aiming to test your coding ability and understanding on basic concepts.

This course should be quite easy even if you have no programming experience at all and should not take you too much time per week.

Anthony Ho Class of 2008 (written May 2005)

==========

15-100 covers basics of Java programming from simple 'hello world' program to arrays. It covers core concepts such as states, classes, objects and variables. Basically this course is designed for those who 'never' had programming experience before. Therefore it might seem boring to students who have some programming experience and quite familiar to Java. They would want to choose 15-111 or 15-200 rather than this course. It also covers how to use Mac machines and OS X for those who never used them. Lecture is held three hours a week and there is no recitation. Lecture is mostly covered by free discussion, questions and answers about the topic. It would be good to read relative materials before the class. There are programming assignments through the entire semester. Early programming assignments, which are quite simple, are handed out for every lecture. Late, more complicated ones are usually for a week. There are also two written exams and two programming exams during the semester. Especially written exams would be difficult if one doesn't catch core concepts. Grading procedure is quite generous and one would rarely complain about the grading. There are many chances to get partial credits from assignments and exams. Each programming assignments counts for 2% of total grades. First in-class exam, which is written exam, counts 5% of total grades. Second exam, which is programming exam, counts 10% of total grades. Third exam counts 15% and fourth exam counts 20%. Final exam also counts 20%. This grading system gives students a chance to improve their performance throughout the semester and get higher grade for their improvement. There is no curve, but most students get high grades. Early lectures would seem very difficult for students with no or little programming experience. However, as basic and abstract concepts are taught and the lecture moves to application, it would be quite easy to catch up the class. Officially the class requires 10 hours of studying a week including lectures. Practically it would not require that much study time, but programming assignments for a week can be real disaster if it had been delayed too much for laziness. Office hours are offered for students who would like to get help for either assignments or covered material.

Hwee Kim Class of 2008 (written May 2005)

15-113: (Computer Science) System Skills in C (Hoffman)

This class serves as an introduction to the C programming language. The class teaches the basic syntax of standard ANSI C and explores a few rudimentary implementations of data structures to solve simple problems. The class covers the general syntax differences between C and Java and explores topics like pointers, strings, arrays, dynamic memory allocation, pointer arithmetic, debugging, makefiles, bit operations, structs, and nested structs.

This half-semester mini course consists of a 90-minute lecture Tuesdays and Thursdays in an Apple computer lab. The professor goes over the main ideas of the given topic and provides both symbolic and real code examples. Questions are also answered concerning the week's programming assignment, and the professor and students often writes some of this code together.

Weekly programming assignments serve as the homework for the course. These "labs" are typically assigned on Thursday and are due the following Friday. Assignments usually ask the student to write a main function and multiple auxiliary functions to solve a given problem. Readings from a C manual of the student's choice are also assigned. It is typically enough to skim through these readings before hacking out the week's lab.

Homework assignments take a couple of hours on average. The programs are not difficult, but the amount of time spent on them grows exponentially with the number of errors the student manages to create. Depending on luck and the student's understanding of the material, an assignment might take only 30 minutes to complete.

Homework must be submitted to an online submission system by 11:59 PM every Friday. A TA tests the program on several platforms (typically Windows, Unix, and Solaris) and assigns a grade. The number of percentage points to be deducted for certain mistakes is clearly outlined in the writeup for each lab. Grades are usually e-mailed to students within a few days of the assignment's due date.

The grading scheme is as follows: 50% for five programming labs, 20% for an in-class midterm, and 30% for an in-class final. A copious amount of extra credit is available. Programming labs will typically include an extra credit task worth 5% of the program's grade. The midterm includes several extra credit questions worth about 15% of the midterm grade in total. There is also an extra lab worth about 10% of the final grade.

Jason Economou Class of 2008 (written May 2005)

==========

This course is designed for advanced programmers who don't know C, and it shows. Despite the course being numbered in the 100s, the material covered assumes a broad knowledge of data structures and algorithms. The course begins with an introduction to pointers, and the first program involves implementing a fixed array of strings. The assignment includes information on string as character arrays, library functions, and basic pointer usage. The course continues with memory allocation (malloc and free), header files, reading and writing files, dynamic memory allocation, structs, and struct arrays. This culminates in a final program involving dynamic arrays of structs with pointer arrays and dynamically allocated Strings, generated from a text file. Along with these programs are small readings on these concepts, such as how memory blocks are treated and how double and triple star pointers are used. GDB is also covered for debugging programs. Additional material covered includes function pointers and makefiles, time allowing. The textbook is optional, but recommended, especially if you've never used C or C++ before. The course consists of five programs, plus a sixth extra credit program. There is also a written midterm and programming final exam. Since this course is a mini and it 's designed purely as preparation for 15-213, it moves extremely fast. Instead of introducing concepts and ideas such as linked lists and sorting algorithms, the course teaches their implementation in C. The programs are fairly straightforward but difficult, demanding several hours of time each for coding, and a few more for debugging. The midterm is difficult, and is usually curved up to a 75% average. The final is straightforward, and fairly easy compared to the programming assignments. The class is graded on a traditional 90/80/70/60 scale. It is possible, and recommended, to test out of this class if you already know C.

Alan Vangpat Class of 2008 (written May 2005)

15-200: (Computer Science) Advanced Programming/Practicum (Pattis)

This course serves as an introduction to (or review of) the Java programming language and examines a few data structures and algorithms that are useful in programming. It is required for majors who have not received credit through AP or other means. The course begins with a quick overview of Java syntax and coding style before examining arrays, collections, interfaces, class hierarchies, reflection, linked lists, trees, graphs, and model-view-controller programs.

15-200 is taught in one-hour lectures on Monday, Wednesday, and Friday. One-hour recitations are on Tuesdays and Thursdays, though one recitation day is optional for students who have already completed the current week's programming assignment. Online notes for each lecture are available several days in advance, so the actual class time is used to explore examples and answer students' specific questions.

The main workload consists of 11 one- or two-week programming assignments over the course of the semester. For about half of these assignments, students are required to pair up with a partner; this stresses the importance of the skills needed to work in a group. In addition, there is an in-depth take-home quiz each week. Students are also expected to have read the day's lecture notes before coming to class.

Students typically spend the most time reading the extensive lecture notes. However, while the first few programs are light in difficulty, as the programs get more involved, the lecture notes get shorter, so a balanced workload is maintained. Programming assignments typically take a few hours to complete. Each take-home quiz takes about 15 to 30 minutes.

Programming assignments are graded based on style and correctness. The grading scheme is always straightforward, describing exactly how many points each element is worth. Extra credit is occasionally offered for having the best or most interesting program, and is always available as a reward for handing in programs early. Quizzes are returned swiftly and accurately reflect how well the student has learned the material.

The final grade is determined by the scores from nine quizzes (19%), 11 programming assignments (27%), two pencil-and-paper midterms (17%), two programming midterms (17%), and a final exam (20%).

Jason Economou Class of 2008 (written May 2005)

==========

15-200 is an Intermediate Java Programming course. It is required for any computer science degree. Most incoming freshmen take this course in the fall. This course does not assume any previous knowledge of Java, but does to a certain extent assume prior programming experience in some language.

Material covered in this course includes classes, types, compile time versus run time behavior, linked lists, binary search trees, arrays, collection classes, interfaces, iterators, class hierarchies, exceptions, inner and anonymous classes, abstract classes, recursion, and basic asymptotic analysis. In the fall 2003 offering of this course, the first month was spent writing Java programs, using the GetALife framework. The GAL framework allows students to become accustomed with interfaces, iterators, abstract classes, and inheritance, features that are not in other introductory programming languages. The class is taught in a somewhat informal lecture format. There are two one and half hour lectures and one one-hour recitation per week. The recitation is held in a computer lab and focuses on practical programming questions.

There are ten one-week programming assignments with topics ranging from GAL simulations to photomosaics to graph implementations. These assignments are of medium difficulty and are each worth 30 points. You should expect to spend about five hours per week on these assignments. There are two written exams and two programming exams throughout the semester. Written exams are each worth 150 points and programming exams are worth 100 points. The written exams are often quite challenging and require answering short-answer questions along with writing code fragments. The final exam is a department exam and focuses on linked lists and binary search trees. For the final, descriptions of forty methods are given about a month in advance. On the test day, four of these methods will be chosen. Since a pool of forty is given ahead of time, it is easy to prepare for, if you are willing to spend the time.

The final grade is determined by the number of points you earned out of a total of 1000 points; again, 30 points for each of the ten assignments, 150 points each for the written exams, 100 points for the programming exams, and 200 points for the final exam.

Henry DeYoung, Class of 2007 (written May 2004)

15-211: (Computer Science) Fundamental Data Structures and Algorithms

Note: *Most of you will take this course in the Spring Semester.*

This class is an introduction to the fundamental data structures and algorithms that form the basis for computer science, taught in Java. This is not a class to learn Java; it focuses on using the language to cover such topics as non-destructive lists, balanced binary search trees, hashing, priority queues and heaps, data compression, sorting, graph algorithms, greedy algorithms and dynamic programming, game trees, and computational geometry. Each data structure and algorithm is presented theoretically and with applications with an emphasis on elegance and time complexity. The class consists of lectures that treat the topics thematically on a fairly high level and recitations that serve to fill in the gaps between lectures. These lectures are very important because it is difficult to learn the material from a fairly dense textbook; the lectures serve to distill and simplify the material to a more reasonable level.

The heart of this class is the programming sets, which take a greater amount of time than one might expect. There are seven programs: one is very easy, three are individual week long problems of mid-range difficultly, and three are complex three-week long problems that students can work on in groups of two. One should probably expect to spend about 8-10 hours a week on these programs, which are very important because they are worth about 50% of one's grade. The programs really are not overwhelming they are started early and spread across the time allotted; however, many students fall into the trap of waiting until the last minutes. If one can avoid the lateness trap, the homework is quite possible. The

midterm and online quizzes are tricky but also possible—this accounts for about 70% of one's grade. The rest of the grade comes from a comprehensive final worth 25% of the grade and a 5% bit that is determined by TA discretion (again, go to class!). The final grade is curved somewhat, but if one takes the initiative to go to class and do the homework at a reasonable time, this can be a very rewarding and interesting class that will ready students for 15212 and 15213.

Will Haines, Class of 2007 (written April 2004)

==========

As its name suggests, this class introduces students to various data structures and algorithms that are useful in solving real-world programming problems. The course begins with discussions of runtime complexity and goes on to describe data structures such as hash tables, binary search trees, tries, splay trees, heaps, and graphs. The class explores algorithms to solve problems concerning hashing, sorting, searching, compression, graph traversal, string matching, and artificial intelligence (game trees).

15-211 is taught as a Tuesday/Thursday 90-minute lecture, in which the material is typically presented using PowerPoint slides. There is also a weekly hour-long recitation, where TAs reinforce the material covered in lecture and answer questions concerning homework assignments. The material is broken up into well-defined chunks, with each topic supported by a corresponding two- or three-week programming problem.

These programming problems, written in Java, typically provide the students with some base code and ask them to write a data structure and implement an algorithm or two in order to access the data structure, solving some problem. The assignments range from writing a hash table class to implementing a trio of compression algorithms. Brief quizzes are given in recitation every few weeks, but the topics to be covered are always clearly laid out and thoroughly reviewed. There is also a 90-minute in-lecture midterm and a normal final exam during finals week.

Programming assignments account for most of the time students spend working on this course. A couple assignments take only an hour or two, but most take quite a few hours to complete. However, some students wait until only a day or so before the deadline to begin and still manage to hand in their assignments.

Assignments are submitted to FrontDesk, an online grading system. The TA assigns a grade to each program based on coding style and automated JUnit correctness tests. Quizzes typically contain only two or three questions. The midterm is essentially a very long quiz with a few in-depth questions, but whereas quizzes focus on conceptual ideas, the exams expect some knowledge of implementation details.

The final grade roughly depends upon the six programming assignments, the midterm and final exams, and 3or 4 quizzes

Jason Economou Class of 2008 (written May 2005)

15-212: (Computer Science) Principles of Programming

Meets every Tuesday and Thursday for 1.5 hours, with a 1 hour recitation on Wednesday. In lecture, it's mostly the teacher writing on the blackboard with students taking notes. Recitation is a chance for TAs to field questions and give examples to topics covered in lecture, as well as to return homework and tests. 15-212 is a course designed to teach students the basics of functional programming (as opposed to C/Java style imperative programming), a brief overview of computability and correctness, and also serves as a foundation for many of the higher level computer science courses (Databases, Algorithms, etc.). The course starts at the very basics of SML programming (declaring types, writing functions), then goes on to more advanced topics (higher-order functions, streams, computability and decidability). Homework is given about every 2-3 weeks, and is always a programming project (with occasional integrated proofs or explanations). Homework ranges greatly in difficulty (the first assignment takes no more than 2 hours, while the later ones can take entire weeks of work). There is one midterm exam, as well as one final exam. Your TA grades your work, and typically returns it in recitation the week after it was due. Final grade is half homeworks/half tests.

15-212 is designed to change the way you view programming, and as a result, is fairly confusing until you get the hang of it. If you completely understand the topics and main ideas, the homeworks and tests will seem very intuitive and straightforward, but it's very hard to "get by" in the course if you're lost on what's going on.

Sammuel Wang of 2009 (written June 2006)

15-251: (Computer Science) Great Theoretical Ideas in Computer Science

Note: Most of you will take this course in the spring semester.

15-251 is a required first-year intensive introduction to key ideas in computer science theory. One incredibly fundamental idea is the concept of choosing the right representation for a problem. Choosing the representation correctly allows proofs that are easy to understand and verify, and allows students to relate seemingly new problems to old problems they have seen before. A few other examples are principles of counting (ie: combinatorics), number theory (ie. modular arithmetic), cryptography (ie: RSA), proving theorems (ie: induction, contradiction), probabilistic methods (ie: random walks, expected value).

Lectures are traditionally given by Steven Rudich (who sometimes works with a second professor) and are presented through Powerpoint slides. Recently, videos of lectures have been made available on the course website (http://www.cs.cmu.edu/~15251). Weekly homeworks are assigned and are usually very challenging even to the most well-prepared students. Spending over ten hours on a single assignment is not unusual. For example, one homework assignment involves designing the blueprints for a complete CPU from basic NAND gates. Another involves coding a self-cannibalizing computer program. While time-consuming, each assignment a few key concepts, many of which will be seen again in other classes (and even interviews!). A team of teaching assistants (experienced undergraduate and graduate

students) grade assignments and provide weekly recitation sections to reinforce lecture material. They also each hold weekly office hours which are absolutely crucial if students find themselves falling behind in this very fast-paced course. At office hours, students can receive hints on homework problems and revise confusing lecture/recitation material. In addition to homeworks, there are 3 quizzes and a final exam that contribute to the overall grade.

Overall, this is one of the hardest classes computer science majors will encounter during their time at CMU. At times, 251 will seem overly frustrating: homework problems will seem impossible and lectures will be overwhelming. Students will often receive their first ever non-"A" grade in this class, and thus 251 is a wakeup call for many first year majors. However, it is a great learning experience and if taken seriously, results in a solid foundation that will pay dividends later on.

Jonathan Lee , Class of 2007 (written April 2004)

==========

A discrete math course, that covers material such as probability and combinatory, graph theory, number theory, and induction. There are two 1.5 hr lectures and one 1 hr recitation each week. The lectures are primarily power point format, while the recitation is much more interactive. Homework is the main learning component of the course. The weekly homework assignments require that you pull together information and concepts from both lecture and recitation and develop the ability to think creatively and outside the box. The homework takes about 8 hours to complete and involves a variety of proofs, computations, and generation of algorithms. The course is designed for you to take away a variety of problem solving tools , the ability to examine a problem from multiple angles, and to teach you to not just look at a problem and say it is too hard. Homeworks make up 40% of the final grade (with the lowest one dropped), 30% of the grade comes from quizzes (with the lowest one of the 3 dropped), and the final makes up the remaining 30%. If you go in with an open mind ready to learn, 15-251 can be one of the most amazing classes you will ever take, and you can learn more from it than any other course, in that it ties course materiel from other courses together, giving you a broader view of how your academics are interrelated.

Gwendolyn Stockman Class of 2006 (written April 2003)

21-120 (Mathematics) Differential and Integral Calculus

This first half of the course covers the basics of calculus, beginning with functions (linear, quadratic, and trigonometric) and limits, including infinite limits and L'Hopital's rule. This leads into basic derivatives and the Mean Value theorem, which follows with trigonometric derivatives and functions, the chain rule, substitution rule, and second, third, and further derivatives. This knowledge of derivatives is used to study approximation, max/min problems, and related rates, and is used to study curve sketching. The second half of the course focuses mainly on integration and basic methods of integration, including integration of trigonometric functions, common integrals, integration by substitution, and integration by parts. Inverse trigonometric functions are also briefly covered, as well as basic hyperbolic functions. Other topics include the fundamental theorem of calculus and uses for integration. The course itself consists of three hour-long lectures and two hour-long recitations a week. The lecture presents new material, and the recitations are designed to allow you to practice these techniques, so attendance to both is highly recommended. There are homework problems due every week, although they are generally not very time-consuming, and are chosen to ensure you understand the concepts rather than to force you to think about them. This means the workload for the class is mainly in attending class and ensuring you understand the concepts, rather than in any graded assignments. The exams consist of problems similar to the homework, but calculators are not allowed, meaning the required calculations are more basic. The course is graded on the basis of homework, three in-class exams, and a final, with a typical 90/80/70/60 scale. Final grades are determined with varying weights, and the final exam may be weighed more heavily in the event that overall class performance is lower than expected.

Alan Vangpat Class of 2008 (written May 2005)

21-122: (Mathematics) Integration, Differential Equations, and Approximation (Calculus 2)

This class is basically a Calculus 2 class, the one that should follow AB Calculus in the Advanced Placement scheme. In lectures and recitations, it covers and reinforces such calculus topics as integration by parts, trigonometric integrals, approximate integrals, improper integrals, arc length applications, basic differential equations, separable and linear differential equations, sequences, series, convergence/divergence tests, power series, and Taylor series. The lectures take a fairly brisk pace, but the work is not overwhelming, probably in the range of 4-6 hours per week reading and working problem sets. The lectures are taught at a level slightly below that of the homework and tests; recitations tend to close that gap somewhat.

This class is fairly challenging, and attendance of lectures and recitations will go a long way to preparing students for the three or so midterm exams, which can be quite challenging. However, if one studies and seeks help, the tests are not insurmountable. They account for about 60% of one's grade, with less emphasis being placed on the lowest scoring test than on the other two. The homework sets are worth only 15% of the grade, but they are *essential* to understanding the material—without homework practice, it is easy to let the lectures get away from one's grasp. The material here is challenging, but not so difficult as to completely take up all of one's time. This is a class that can be paired with other challenging courses, but one should expect to spend some time on the material to get a good grade. A comprehensive final accounts for the last 25% of one's grade; be warned, this class breaks up into three fairly unrelated topics, as the name indicates, and the final is very difficult if students fail to review the entire semester. It is easy to forget how to integrate when approximation rolls around, but a thorough review can master the exam. Overall, this is a tough course, but it is not so difficult as to be frustrating; a good work ethic will go a long way towards a good grade in the class.

Will Haines, Class of 2007 (written April 2004)

21-127: (Mathematics) Concepts of Mathematics

This is an introductory course on discrete mathematics, covering a diverse set of topics ranging from logic, induction, number theory, set theory, functions, modular arithmetic and graph theory. Little to no background knowledge is assumed beyond basic arithmetic, and many fundamental theorems and major results of mathematics are examined and derived from first principles, thus making this a very different course from typical high school mathematics classes. This course is compulsory for all CS freshmen, and is usually taken in the first semester with an entire lecture dedicated to the incoming CS class. All material is taught in the regular lectures, with recitations devoted to clarification of material covered in lecture as well as for the administration of multiple-choice quizzes. These quizzes are given every alternate week throughout the entire semester, with homework problem sets due during the other weeks. Expect to spend an average of about five hours on each homework, which consists of about ten problems of medium to hard difficulty based on the current lecture topics. About half the course grade comes from the quizzes, with the remaining half split evenly between the homeworks and the final examination. Overall, this is an interesting course that sets the tone and lays the necessary groundwork for the level for mathematical understanding required for subsequent CS courses.

Kelvin Lim, Class of 2007 (written May 2003

==========

21-127 serves as an introduction to mathematical concepts behind computer science. It is required of all computer science freshmen in the fall semester, as preparation for 15-251 Great Theoretical Ideas in Computer Science. Concepts of Mathematics is typically taught by Professor Richard Statman, with a slightly modified curriculum specialized for computer science students. Material covered includes the Euclidean Division Theorem and GCD Algorithm, solving linear Diophantine Equations, Modular Arithmetic and Congruences , Mathematical Induction and solving basic recurrences, basic set theory, binomial coefficients and combinatorics, permutations, graph theory, and logic.

The course is taught in a lecture format, with three one-hour lectures and two one-hour recitations a week. In lectures, major theorems are introduced and proven formally, unlike a typical high school math course. However, material is also presented in terms of classic mathematical puzzles, such as finding the faulty coin in a pile of n coins, using only a balance, tiling a chess board with L shaped triominoes, and Sam Loyd's puzzle. Recitations typically review the material covered in lecture and answer any questions students might have. Sample problems are also presented in recitation.

Each week, there is either a quiz or homework due in Thursday's recitation. Quizzes and homework alternate each week. Each of the six quizzes is made of ten multiple-choice questions, which despite the format should not be underestimated. Quizzes are graded by TA's, with little partial credit, given the multiple-choice format. Each of the six homeworks is made of ten problems taken from the textbook ranging in difficulty. Homeworks are graded strictly. The final grade is calculated by taking your top five quiz scores, given a weight of 50 %, adding the top five homework scores, which are given a weight of 25%, and adding the final exam, which is worth 25%. The best preparation for the final is to review old quizzes.

Overall, the course requires about four hours of work per week. On quiz weeks, the work load is significantly lower than on homework weeks which require some amount of thought.

Henry DeYoung, class of 2007 (written May 2004)

21-131: (Mathematics) Analysis I

Analysis I is the first course in a sequence of four intensive courses designed for students interested in an honors degree in Mathematics. Although Analysis I covers material found in the standard Calculus I courses, it does so in a much different fashion. Ostensibly, Analysis I serves as a Calculus course, but it should not be taken without knowledge of Calculus; nearly all students give up AP credit to take this course.

To start, basic axioms and simple algebraic proofs are covered, moving on to suprema and infima. The second unit is comprised of the development of integral calculus from just a few axioms. Instead of taking the standard formulas for granted, these formulas are derived and rigorously verified. The third unit consists of limits and continuity, and the fourth unit consists of differentiation. In each case, the theory is emphasized over pure computation. Almost no time is spent reviewing the computational aspects of Calculus. This is why it is crucial that students have previous knowledge of Calculus.

The class in taught in a lecture format. The three one-hour lectures a week are complemented by two one-hour recitations, which review previous homeworks and solidify topics presented in lecture. There are approximately twelve homeworks over the semester, about one per week. Homeworks vary in length, but usually consist of six or eight problems. Some problems are taken directly from the textbook while others are written by the professor. Homeworks focus on proofs but do contain the occasional computational problem, and are good preparation for the tests. There are four tests given in lecture, one after each unit. Tests typically consist of only four problems, three of which are proofs. Tests are very difficult and scores can be quite low, but this is taken into account in the grading. You should expect to spend about seven hours per week on homeworks.

The final grade is calculated by weighting your average on the four tests as 60%, the homeworks and final exam are each worth 20%. This is not an easy course as proofs are heavily emphasized. Many students who take Analysis I do not return for Analysis II the following semester.

Henry DeYoung, Class of 2007 (written May 2004)

==========

This course, along with Analysis II, is a very rigorous version of the introductory calculus sequence. It is not a course for students who have never taken calculus before. The majority of the class gives up AP credit or the equivalent to take it.

Very little of the course is computational. Instead, the course focuses on the theory behind all the rules you learned the first time you took calculus. The majority of homework problems are proofs. For example, the very first homework involves proving that for sets A, B,C: (A U B) U C = A U (B U C). Don't worry if you have never seen set theory or proof before, but if you look at this problem and don't see the point of proving something so trivial, this is not a course for you. The homework assignments can be extremely long and difficult, especially the early ones. Expect to spend at least five hours on each homework assignment. The order of the course is somewhat non-standard. It starts with a study of the real numbers and basic set theory. Then it covers portions of integral calculus before doing any differential calculus. After it gets to differential, it moves in a more conventional fashion. Towards the end of Analysis II, several extra topics are covered including complex numbers and more advanced differential equations. The grade for the course is based solely on homework and five tests. Each problem on a homework assignment is worth 3 points, and the final homework grade is adjusted to be out of 100. The lowest of the five 100 point tests is dropped, for a total of 500 points. Then the professor subjectively determines cutoffs for letter grades. Grades on tests tend to be fairly low, but this is taken into account in establishing the cutoffs. This is a very difficult course. By the end of Analysis II, only a third of the people who started in the fall were still taking the course. It is not a course for everyone, but if you have a strong interest in math and are considering a minor or double major, it is definitely worth taking. Just be aware that it is almost certainly different from any math course you have ever taken.

Ian Kash Class of 2006 (written May 2002)

21-241: (Mathematics) Matrix Algebra

This course covers general linear algebra topics, especially matrices. It consists of lectures that cover matrices and their operations, row reductions, linear systems, linear transformations, determinants, vector spaces, bases, rank, eigenvalues and eigenvectors, orthogonality, and quadratic forms. These lectures cover about one section in the textbook per lecture. Different semesters have had different setups for recitations, but if recitations exist at all, they generally serve to reinforce the computational aspects of matrix algebra. This course is not particularly demanding on a conceptual level, but it is easy to get bogged down in arithmetic.

The only work for this class is homework and reading the textbook, which together should take no more than 4-5 hours. The homework sets tend to be a bit harder than the examples in lecture, but it is not so difficult as to require much outside help; the exams tend to fall somewhere between the homework difficulty and lecture difficulty. The major concern for tests is time—all the calculations can take a significant amount of time even if they are easy individually. Grading for the course takes this difficultly into account, as the grading bounds are lower than in most classes, about 85% for an A, 75% for a B, 65% for a C, and 50% for a D. The grades are determined as follows: about 15% homework, 60% exams (there are about 3 exams), and 25% for the final. This makes the class exam-heavy, but the exams are probably easier than the homework.

Overall, this is a pretty dry class that falls outside of the area of interest of many CS students, but for a math requirement course it is pretty painless as long as one keeps up with the work. One word of advice: this is a class that *many* students tend to skip because it is "boring" or "pointless"; however, most students would be more well served by sticking with it—this is one of the easier required CS classes, and everyone likes to get a good grade.

Will Haines, Class of 2007 (written April 2004)

==========

Usually freshmen aren't in this class but if you have credit for calculus you should definitely think about taking this course. A few higher level courses require this as a prereq and also it's a required course for CS. Material is not too difficult but the most important part is staying up and on track with material, because once you fall behind it is hard to catch up as material throughout the semester is based upon previous chapters. The fall teacher, Prof. Tolle is a good teacher however is very strict with grades, so make sure you don't end up with an 89.8. Material covers a lot, ranging from Gauss-Jordanian algorithm, to matrix transposes, inverses, etc. About each week an assignment is due, and the assignments usually take about 3 hours each. It's good to have another friend in this course as its helpful to check answers and study together. There are three exams during the year and then a comprehensive final, and your final grade is determined on two scales (one weighs the homework assignments more, one weighs tests more) depending on which gives you the better average. Tolle did not curve, so again, shoot for an A from the beginning. This class is very doable as a freshman, first semester, as long as you can stay awake in lecture and take good notes.

Sana Yousuf Class of 2007 (written April 2004)

21-259: (Mathematics) Calculus in Three Dimensions

Calculus in 3-D is one of the math classes you can take after you finish the calculus sequence. It is also a prerequisite for a lot of graphic classes you might want to take in the future. The topics covered in this class were vectors, surfaces, cylindrical and spherical coordinates and multiple integrals. A few topics were covered each week and applied to a set of homework problems. The weekly homework for this class was optional, but doing, or even just attempting, the homework can help boost your grade at the end of the semester. The lecture meet 3 times a week and the recitation meet 2 times a week. This class required about 2 to 3 hours of work each week (if you did the homework) and there were 3 exams and 1 final. Just before each exam, the professor held a very helpful review session where he went over the types of problems you could expect to see on the exam. Your grade was calculated by using either all 3 exams and the final or your 2 best exams and the final.

Calc in 3-D, or 3-D Calc (both typical abbreviations), is an intense calculus course based heavily on vector calculus and requiring a good knowledge of integral and differential calculus. 3D Calc covers the later half of the standard CMU calculus book (Chapters 12 through 16), spanning the gap between most Calculus 2 classes and Differential Equations. Topics covered include vectors, 3D functions, vector functions (of several variables), partial derivatives (and approximation), directional derivatives, Lagrange multipliers, iterated integrals (double and triple), line integrals, surface integrals, curl, divergence (and the divergence theorem), flux, and Stokes Theorem, plus many subtopics within those mentioned.

The course is taught primarily via lecture, which, by my experience, tended to be rather large (in excess of 100 students) and fairly well attended. Professor Schaeffer presents very methodical and informationally dense lectures that, while not particularly exciting, do a very good job of explaining material. During the Fall '01 semester, the last two sections were self-taught with un-graded homework.

Recitations, run by teaching assistants, are a valuable teaching aid, serving both to help in explaining homework sets as well as to resolve questions regarding lecture material. The TA staff is usually highly qualified and available outside of class and recitation.

The workload for 3D Calc can be somewhat daunting at times. Long homework assignments and tests averaging every three weeks or less puts a bit of a time crunch on incoming freshmen, but with a little time management work, the workload is quite manageable. I would suggest any student taking this course not plan on doing homework the night before it is due, and never count on TA's to do it for you. This is a dangerous strategy. Weekly workloads range form about six to ten plus out-of-class hours.

Grades are assessed by a weighted combination of homework and test averages and a final exam. Grading is done by the team of TAs, which leads to sometimes inconstant, yet fair grading, and very little curve, if any, is ever applied. NOTE: This class is a popular pre-requisite for graphics and robotics.

Erik Martin Class of 2006 (written May 2002)

21-341: (Mathematics) Linear Algebra

Strongly recommends 21-127 (Concepts of Mathematics) as a prerequisite. Meets every Monday, Wednesday, and Friday for 1 hour each day. No recitations or TAs, class size is about 35. The course starts at the foundations of Linear Algebra (Fields, Vector Spaces, Subspaces), then progresses into Linear Transformations, and ends with Determinants and Eigenvectors/Eigenvalues. When taught by William Hrusa, class was conducted by teacher lecturing and writing notes on the blackboard, with occasional questions to students. All assignments and solutions were posted on Blackboard. There was typically one homework assignment about every two weeks, with each assignment consisting of several practice problems with solutions given along with 3-4 problems for turning in. Depending on the difficulty of the topic, each question on the assignment ranged between 15 minutes to an hour or more to solve. Almost all of the homework questions asked were proof-based problems (Show this property holds...) as opposed to problems where a numerical solution is sufficient. There were 3 tests, 2 in-class and one take-home, along with a comprehensive final. Tests were about 50% numerical solutions problems, along with 50% proofs.

Hrusa had review sessions during the evenings before each homework due date and test, where he fielded questions from students about any topics that have been covered. Final grade is determined by a weighted average of homeworks, tests, and final (with emphasis on the 3 semester tests). Computer science students have the option between this and Matrix Algebra (21-241). 21-341 is much more theoretical and proof-based, while 21-241 tends to be more procedural (To do <this> to a matrix, first do <this>, then do <this>, ...). 21-341 is probably more challenging of a course, but the early exposure to proofs and higher-level mathematics will make later coursework easier to grasp (such as 15-251 or any other 300-level math course).

Samuel Wang of 2009 (written June 2006)

33-111: (Physics) Physics for Science Students I

This is an introductory physics course that deals with the science of motion using basic calculus. It is taught from the same textbook as Matter and Interactions 1 and Physics for Engineers 1; however, the classes are not all the same. Where Matter and Interactions is a more difficult, class for those students truly interested in physics (perhaps as a minor), Physics for Science Students and Physics for Engineers are focused on Scientists and Engineers respectively. Science Students is not like most high-school physics classes; it is more focused on using theoretical ideas to derive formulas than on memorizing formulas for specific situations. If high-school type computation is more your speed, Engineers may be right for you. If you are more interested in a unified view the Science Students may be worth the extra trouble.

Topics covered include vectors, forces, impulse and momentum, classical motion in two dimensions, energy, rotation, relativity, and probabilistic physics. Everything is tied up in surprisingly few formulas; lectures teach the general concepts and recitations reinforce them with simple problems that teach basic concepts. The homework problems and tests are *much* more difficult; expect to spend around 8 to 10 hours a week studying, doing homework, and seeking help at the course center. *Do not* expect to do well in this course without spending lots of time at the course center. There are three (2 hour) midterms that account for 45% of one's grade, along with difficult homework sets that count for 10%, basic Python programming labs and real labs that count for another 10%, a final that counts for 30%, and 5% that is purely attendance. I emphasize that the homework and tests will ruin one's grade if one does not study and seek help early and often. Although the final grade is curved somewhat, it is up to students to actually learn the additional material that is not covered in lecture.

This class is rewarding to someone who has an interest in physics as a unified science, but who does not want to focus deeply on the subject. Matter and Interactions or Engineers may be a better choice—consider all of them before making a decision.

Will Haines, Class of 2007 (written April 2004)

==========

This course covers the mechanics part of physics as an overview. The course teaches the basics, but very quickly, so some knowledge of the subject before this class is helpful, but definitely not mandatory. Theory and general understanding of material is emphasized more than the numbers themselves. Being able to explain why something happens is important. The course starts out with vectors and vector math, and continues to stress the importance of knowing what directions different forces and momentum vectors are pointing in. It focuses on momentum more than anything else and how most other equations can be expressed in terms of it. The class is taught on a microscopic level, focusing more on atomic interactions rather than on whole body interactions (macroscopic) but both are covered. Because there is the atomic aspect of the course, relativity is touched on as well. Physics for Engineers I is more macroscopic, stressing big force interactions and less atomic interactions. There are lectures 3 days per week and the other two days are recitations. The lectures cover the course material, and the recitations cover how do solve theoretical problems and serve as practice for the homework. After recitation, answers to the problems that were done in class are posted. In class demos are used to explain and prove the equations and theories that are learned during lectures. There are both teaching assistants and teaching assistant assistants, the prior ones are graduate students and the latter are undergraduates. Two professors from the University who studied the best ways for students to remember the material wrote the "textbook" that is used. It's more like a thick workbook. The book is somewhat useful, but the equations and answers to questions you might have are often hard to find quickly. There are typically around 5 or so problems given from the textbook per week, and they are turned in either during recitation or before lectures. Homework is also graded, mostly for completion but also for correctness on chosen problems. There are weekly quizzes during lecture to see how well the students understand the material. Three tests are given during the semester covering the most recent topics and the final covers everything in the semester. The final grade is a combination of the homework, quizzes, tests, and the final. The grading scales are given at the beginning of the semester but are often changed at the end of the semester to reflect the average performance in the class.

Stephanie Rosenthal Class of 2007 (written April 2004)

33-112: (Physics) Physics for Science Students II

This course covers the electricity and magnetism part of physics as an overview. It teaches the basics, but very quickly, so some knowledge of the subject before this class is helpful, but not mandatory. Theory and general understanding of material and the reasoning behind it is emphasized. The course stresses electric fields and magnetic fields and focuses a lot on how the equations are derived for them for different charged objects. It stresses the microscopic view of circuits and charges rather than the macroscopic, so the electron current and atomic views of wires are covered more than circuit diagrams. The course tries to build up ideas from the beginning of the course deriving formula from previous ones. As opposed to Physics for Engineers II, Gauss's law and other big laws are taught last after building up to them through the beginning course material. There are lectures 3 days per week and the other two days are recitations. The lectures cover the course material, and the recitations cover how do solve theoretical problems and serve as practice for the homework. Two professors from the University who studied the best ways for students to remember the material wrote the "textbook" that is used. The book focuses on learning through experimentation, so you must buy the corresponding kit that contains materials that you need for the experiments. The experiments are done in both lecture and recitation. Finding actual equations is quite difficult in this book; it requires you to figure out the equations yourself through the corresponding experiments. There are typically around 5 or so problems given from the textbook per week, and they are turned in either during recitation or lecture. Homework is graded, mostly for completion but also for correctness on selected problems. There are weekly quizzes to see how well the students understand the material. There are both teaching assistants and teaching assistant assistants, the prior being graduate students and the latter being undergraduates. The course does not require memorization of equations; equations are given on an equation sheet when needed. Three tests are given during the semester covering the most recent topics and the final covers everything in the semester. The final grade is a combination of the homework, quizzes, tests, and the final.

Stephanie Rosenthal Class of 2007 (written April 2004)

==========

Physics for science students is the second of two parts of the introductory physics program at Carnegie Mellon. There are other courses which are equivalent, most notably Physics for engineers, but CS majors are lumped into the category of science students. It is designed to be taken after having taken the first part (33-111) the previous semester, although it is not necessary if you have credit for the AP Physics C Mechanics exam, very little of the material from the previous course is continued in this one as 33-112 deals with electricity and magnetism, not mechanics. The way Physics is taught is a little different than other science courses you may have taken, while the concepts are the same as most others, some of the notation and methods for doing problems may be new to some of you.

The materials covered are the major theories of electricity and magnetism, from static charge to the nature of light as electromagnetic waves. The class meets 3 times a week and has recitation twice a week. There is usually homework on each week there is not a test, and a few progress quizzes that fall between the major tests. Usually there will be three out-of-class exams which cover several chapters in the book. Grades are usually pretty standard with perhaps a curve to both

test and final grades depending on the class average. This is a difficult course with an above average workload, keep in mind this is a 12 unit course.

33-112 is a good science course for those interested in pursuing a physics minor or who just have an interest in physics. It will be a bit involved but not the most difficult course you will encounter your freshman year.

Zhi Qiao, Class of 2006 (written April 2003)

33-114: (Physics) Physics of Musical Sound

The goal of the course is to learn the basic physics and psychophysics describing the production, transmission and perception of musical sound. It also covers the objective physical quantities that describe sound and relate them to the subjective psychological sensations of music, how the sounds of music are produced in musical instruments, how they travel through the environment surrounding the course and the listener and how they are detected by the ear and interpreted in the brain. This course is taught through three 1-hour lectures every Monday, Wednesday and Friday. There is homework assigned every week and due the week after it is assigned. Homework questions are typically from the text, with a few extra problems written by the professor himself. The course grade is determined by the following percentages: Three 2-hour exams – 45%, Final Exam – 30%, Homework Assignments – 20%, Daily quizzes – 5%. The final grade will not be curved but will follow the grading scale below:

87 – 100 A; 75 – 86 B; 60 – 74 C; 50 – 50 D; < 50 R.

Dahlia Bock Li Chen Class of 2006 (written April 2003)

Physics of Musical Sound is only offered in the spring semester. The current professor is Thomas Ferguson. The class consists of students from all colleges in Carnegie Mellon, however a majority of the students are from MCS or SCS. Also, students are from all class standings, ranging from freshmen to seniors. This course is an introduction to the psychophysics of musical sound. There is an emphasis on musical acoustics, waveforms, the production of sound, the study of the human ear, and the perception of music. Also, a large part of the course is spent on tuning and studying the parts and inner workings of many musical instruments. Although not necessary, it is beneficial to have a musical background of basic theory skills, especially in reading music. Simple algebra and geometry skills are also helpful since there are many calculations. The class consists of three one-hour lectures per week and no recitations. Many demonstrations are conducted such as various musical instruments that are brought in by students in the class. These aid in understanding the material and preparation for exams. Work is assigned by weekly homework assignments consisting of problems from the textbook and "Exam-type" problems. Each homework problem set consists of ten to fifteen problems. Daily reading assignments from the textbook and handouts are also given. Reading assignments usually consist about twenty pages per week. The average amount of time for homework is about two to three hours. Daily reading assignments usually take about ten to fifteen minutes a day. Out of the many problems assigned only two problems are graded for correctness and two for completeness. However, the problems graded are not identified until the homework is returned. Thus, it is best to complete all the homework problems. There are three exams in this course worth 45% of the grade. Each exam is two hours in length and scheduled at night. The exam approximately takes one hour to complete and an extra hour is given to avoid any time constraints. The final exam is worth 30% of the grade and homework is worth 20%. The remaining 5% of the final grade is contributed by unannounced pop quizzes. These quizzes are given in the beginning of class and their main purpose is to enforce attendance and avoid tardiness. Each pop quiz is worth three points, two for attendance and one for correctness. The professor does not have actual office hours. E-mail or stopping by his office is the best way to get help on homework problems or to ask questions.

by Nancy Chen Class of 2005 (written May 2001)

33-131: (Physics) Matter and Interactions I

This introductory phys

ics course covers classical mechanics and thermal physics by teaching students to apply a handful of important fundamental principles to a wide variety of situations. To further enhance the understanding of the principles, students also use the VPython programming language to graphically model physical situations on the computer. Students will spend 4-7 hours a week outside of lecture/recitation reading the book, solving problems for each chapter, and finishing computer problems. Students are required to attend lecture three days of the week and recitation the other two days. The professors give lectures and guide recitations, and they are also the authors of the text. Students actively participate during lecture by performing exercises designed to reinforce the concepts being presented. Recitations consist of students working together to solve practice problems and use the computer to model physical situations. Students' grades are based on a three-hour final exam, three one-hour exams, homework (written and computer problems), weekly quizzes, and attendance.

by Jennifer Cerully Class of 2004 (written April 2002)

33-132: (Physics) Matter and Interactions II

This introductory physics course covers electricity and magnetism by teaching students to apply a handful of important fundamental principles to a wide variety of situations. To further enhance the understanding of the principles, students also use the VPython programming language to graphically model physical situations on the computer. Students will spend 4-7 hours a week outside of lecture/recitation reading the book, solving problems for each chapter, and finishing computer problems. Students are required to attend lecture three days of the week and recitation the other two days. The professors give lectures and guide recitations, and they are also the authors of the text. Students actively participate during lecture by performing exercises designed to reinforce the concepts being presented. Recitations consist of students working together

to solve practice problems and use the computer to model physical situations. Students' grades are based on a three-hour final exam, three one-hour exams, homework (written and computer problems), weekly quizzes, and attendance

by Jennifer Cerully Class of 2004 (written April 2002)

33-211: (Physics) Physics III: Modern Essentials

Meets every Monday, Tuesday, Wednesday, and Friday for an hour. No recitation or TAs. All tests in this class are given at night as opposed to in class, but options are available if you cannot make the chosen test time. This course assumes a knowledge of both mechanics and E/M (mechanics will be more used in the course, however, as opposed to E/M). The course gives an overview of the physics developed during the 20th century (Relativity and Quantum Mechanics). Because the two topics are somewhat disjoint, Relativity is covered in the first half of the semester while Quantum Mechanics is the 2nd half. The course 33-213, Mini-Course in Special Relativity, is a mini that is just 33-211 that ends at relativity (both courses meet together, until 213 ends). The course starts with relativistic effects between events, then moves on to relativistic kinetics (relativity of moving objects), and then gives a brief introduction to General Relativity. Afterwards, it covers the motivations and early discoveries that motivate the study of Quantum Mechanics. Homework is assigned every week, typically 5-6 problems of varying difficulty, and is due the week after. Homework typically takes about 3-4 hours a week, depending on how well you understand the topics that were covered in lecture. Three tests are given during the semester, as well as one comprehensive final. 33-211 serves as a good continuation of Mechanics/E+M, and gives insight into Modern Physics and the problems that motivate physicists today. However, it is more challenging than Mechanics/E+M, as it's much harder to apply intuition to problems like in earlier physics classes (mainly due to the fact that you don't typically travel at near-light speeds often).

by Samuel Want Class of 2009 (written June 2006)

33-224: (Physics) Stars, Galaxies, and the Universe (Fall Only)

An introductory course in Astronomy, designed for those with a solid math and physics background. The course begins with the Astronomical coordinate system, as well as spherical trigonometry, and other fundamentals that will be used for the remainder of the course. After a brief three week introduction, you go into an eight week study of the nature of stars. First you will learn what they are comprised of, and then move onto how they are formed, and finally into how they develop over time. Much emphasis will be placed on the study of the Sun. After extensive studying of stars, the course then moves onto galaxies. You will begin by first studying our own Milky Way Galaxy, and then expanding out to how it is different from others. After about a month study of galaxies, an introduction to cosmology is given. You will learn the different theories about how the Universe formed, and what modern theories are about how it will live out the rest of its life. The class is three hours of lecture per week, and an hour and a half of optional lab one day a week. Each week you will have two assignments, one written, and the other a computer lab. The written homework is generally given out every Friday, and due by the end of the following Friday's lecture. The assignment will usually be five problems, highly mathematical in nature, where you will have to search through the book for appropriate formulae. Lectures only provide enough information to grasp the general concepts; the homework forces you to go through the text, and look into the subject more thoroughly. Aside from the written homework, you will have biweekly computer laboratories, which are designed for students who struggle in science. The manuals walk you through the assignment, and it's very hard to miss anything. As long as you put the time into those, they're easy points. Expect to spend about two hours completing each computer lab, and about three hours on the weekly written assignments. Lecture is also mandatory in this class, because three unannounced quizzes will be given throughout the semester, which generally just test to see if you've paid attention. The only exams given during the course are the two hour midterm, and the three hour final, which are very similar in difficulty to the weekly written homework assignments. Grading: 25% labs, 25% homework and quizzes, 20% midterm, 30% final.

by Joe Trdinich Class of 2004 (written May 2001)

57-173: (Music) Survey of Western Music History

This course covers music from plainchant in the Middle Ages to jazz today. Classes are small and the material is covered mainly though discussion and listening. Music samples enforce the main characteristics of the style of each composer. Generally the only written work required outside of tests and quizzes is concert reviews. You will be expected to attend several concerts on or off campus throughout the semester and analyze them using concepts taught in class. On average you will spend about 5 hours a week on work outside of class. This includes reading, listening, attending concerts, writing reviews, and studying. You will be tested on factual historical information as well as your ability to recognize the style and time period of composers. There is nothing unusual about the grading for this class. The final grade is a combination of tests, quizzes, and concert reviews. There are two professors who teach this course and they have different teaching styles. You may want to find out more about this; however, both are good classes. Musicians will appreciate this class; however, musical experience is definitely not required. This is an enjoyable class and should not be very difficult if you keep up with the work. Emmerson

Maria Emerson Class of 2008 (Written May 2005)

73-100: (Economics) Principles of Economics

This course is a really interesting and challenging introduction to micro-economics. The whole course revolves mainly around supply and demand, and how they are affected by many factors such as monopoly etc. What's really outstanding about this course is that it is taught in a really interesting fashion by Prof Steven Klepper. It consists of in-class lectures

every Monday and Wednesday which occasionaly contain experiments which are meant to reinforce and give a better idea of what you are learning in class. In the experiments you try to make profits by buying and selling assigned commodities, and at the end of the semester, you profits are totalled up and you are assigned lottery tickets based on your profits. Top prize is a cool US$100!!! I won the $10 prize… not bad. The assignments are quite different from the norm too. You are given a course packet which contains the assignment questions and the full solutions to them. Every week, you are required to do the necessary reading from the textbook and then complete the assignments based on your understanding. You are graded totally on EFFORT and not on correctness at all. So even if you come up with some wacky new economic theory but make a concious effort to complete the assignments, you will get 100 marks. Of course, if you get stuck, you can refer to the solutions and get help from your TAs. You will get 0 if your TAs suspects that you copied from the solution, and they're pretty strict about that. I think this is a really interesting way to learn, and its pretty challenging to try learn the concepts on your own first and do the assignments. Then in recitations your TAs will go thru the concepts and help correct your understanding if they are wrong. There are three mid term exams which are worth 10% each, 7 mini-tests during recitations which are worth a total of 15%, another 15% for the homework assignments, and lastly 40% for the final exam. Take this course especially if you didn't do economics before, and take it under Klepper!

Min Chung Kevin, Cheah Class of 2007 (Written May 2004)

This course satisfies one of your humanity requirements. In this course, the basic knowledge in micro economics is covered. These include supply and demand, utility, opportunity cost, elasticity and so on. There is usually one problem set each week which is graded based on effort. That means if you write more, even it is wrong, you will get a hundred. There will be a quiz every two weeks or so. TAs will go over the main point before the quiz so it is not that difficult. Attendence to lecture is not required but it is recommended to go to lectures though as there will be experiments carried out in lectures and a very large percentage of the exams and final will be based on the experiments. This is not an easy course but definitely not hard (if you go to lecture and willing to spend 5 minutes thinking and understanding the materials). The final consists of 100 True/False with no explanations needed. It is HARD (I mean it). But it will be curved anyway so it is not that bad. This course roughly takes 8-9 hours a week. Highly recommend to take this course with Klepper though it is harder. It is fun and you will learn more in a more interesting way.

Anthony Ho Class of 2008 (written May 2005)

76-101: (English) Interpretation and Argument

This class really really depends on your professor. Some teachers had students read about 2 hours each night, some made them write lots of papers, and some teachers had their students do little. In most cases, you will have a book or smaller readings as reading assignments, and then papers based on these readings and extra outside research. The class I was in was based on the Internet and its effects on culture, society, etc. So the reading wasn't so bad (because it was slightly technical.) A lot of other classes had to read a single book (Frankenstein, Dracula) and most of the course was spent analyzing and writing papers on this. Most CS kids don't like this course because it is writing and we are more mathematical people but it's the only mandatory English class you have to take, so definitely get it done with first semester. The amount of homework a week ranges, for me it was about 5 hours a week. The grade was based on a few online quizzes, but mostly papers. Teachers are also very flexible so if you do have trouble you can easily meet with them and they will help you with your paper and its content. Final grades are usually determined by the averages of your papers (for me there were 3 papers all semester.) Again, it's the only mandatory English class so get it down with and out of the way!

Sana Yousuf Class of 2007 (written April 2004)

==========

The material covered in this course is solely determined by your choice of section/instructor. Each section has a different topic, however, all 76-101 sections are trying to teach students to effectively interpret the writings of others and to form effective arguments, in both oral and written form. All sections require 3 papers.

In the Fall '00 sections A and B, Instructor Michael Rectenwald taught the "Science and Technology, and Culture" topic. We interpreted other authors by reading approximately twenty articles and essays over the duration of the course, each written by various members of the scientific and science-studies communities. The readings are organized into five main topics, which include the debate over science and Science Studies, Science and Literature, the Breast Implant debate, Science and Religion, and a Cyber Culture segment. Approximately 50% of the course are spent covering the Science Studies debate, with the other four topics covered in the last half. Science Studies, in a rough definition, is the examination of scientific research and its implications on society and culture, to determine whether or not it is actually operating for the good of humanity (as is widely believed).

Each class contains between 20 and 30 students. Class meets three times per week, for 50 minutes. Rectenwald deals with all responsibilities such as grading, lecturing, and taking attendance (which is mandatory, and affects the participation grade). I believe he may stop taking attendance several weeks into the course.

The coursework involves several simple half-hour long assignments that are used to determine borderline grades, and a host of 3 papers including an in-depth single author Summary, a Synthesis-Analysis (multiple-author summary), and a Contribution (argumentation) essay.

The readings tend to be extremely technical. They range in length from 18 printed pages of size 12 font to 50 printed pages of size 10 font. Students get 2 days or a weekend for a reading, and in an average week, one might spend 6 hours working outside of class.

The grade is determined as follows: Summary essay: 30%; Synthesis/Analysis essay: 30%; Contribution essay: 30%; participation: 10% (includes presentation of Contribution paper).

Chris Yeung (written May 2002)

79-104: (History) Introduction to World History

This class basically covers 5 major locations in the world, at important times in their histories: Moorish Spain, the Americans during the Spanish conquest, China from its ancient history to recent developments, India and Britain and the tea trade, and Africa following colonization. The study of Spain centers around the conflicts between different religions on Spain and the transfer of power between different religious groups. The study of the Americas reviews how different groups of conquerors responded to the native peoples, and how religion both worked with and against the interests of the Conquistadors. The study of China follows the nation from its ancient history through its period of isolationism, and into present day, with focus on how China interacted with the outside world. The study of India and Britain centers on the valuable commodity of tea, and includes tea production in Asia as well. Focuses include the effects of tea on Britain's production, how it may have spurred the industrial revolution, and how tea may have doomed many Asian nations to poverty and third-world status. The study of Africa follows the effects of the white man and modernization on a traditional village, presenting the conflicts between the groups and divisions through belief (or non belief). Each unit has a corresponding book (some non-fiction, some fiction) that the coursework and unit is based around. The course consists of two lectures a week, plus a recitation. The lectures are vital to understanding the material, although they are sometimes a pain to sit through. Recitations consist of discussions of lecture topics and related issues, and review of important concepts. The class is graded on two 5-page essays and participation in recitation as well as a midterm and a final, each consisting of identification questions plus one or two essays. This means that the workload throughout the semester consists almost entirely of reading. If you've been attending lectures and keeping up with reading, the essays are not difficult to write, and do not demand an excessive amount of time. Essays are graded mostly on ideas and arguments rather than grammar or mechanics. The final grades are determined on a standard 90/80/70/60 scale, with the final and midterm weighing more heavily than the two essays.

Alan Vangpat Class of 2008 (written May 2005)

80-150: (Philosophy) The Nature of Reason

This class is an undemanding survey course of logic and probabilistic reasoning that closely follows the text *Thinking Things Through* by Clark Glymour. As a philosophy course, it does not delve into the computational aspects of reasoning, instead focusing on major theoretical topics in the field. Topics covered include the concept of proof, Aristotelian logic, Leibniz's logical calculi, Boolean logic, Frege's introduction of modern logic, Hume's tradition of skepticism, Bayesian and Kantian responses to skepticism, and the concepts of knowledge, reliability, completeness, and correctness. This seems like a great deal of information, and the setup of the course does not allow the class to do all of the topics justice. As a survey course, the topics which will be covered in depth depends primarily on the decisions of the instructor; other topics will be covered briefly or not at all. The topics are covered in outline form in lecture and fleshed out by reading the text.

This class is not very work intensive, requiring some reading of the textbook and a few short (under 5 page) papers. The class oscillates between less than 1 hour of homework on non-paper weeks to maybe 5 hours if one leaves the entire paper until a few days before it is due. Grading is flexible and depends on the quality of the papers and a few in-class (hour long) tests consisting mainly of short answer and short essay questions. There is no final exam, but there is a final paper that is about twice as long as the other papers. The grade breakdown is approximately 30% tests, 40% papers, and 30% final paper. As a breadth requirement class goes, this one is like many others in that it will not take much time away from more difficult classes, and depending on the quality of the instructor, the topics can be interesting especially to students who like proof-based mathematics and want to know more about its development.

Will Haines Class of 2007 (written May 2004)

80-180: (Philosophy) The Nature of Language

The course Nature of Language (80-180) is 9 units. It fulfills the Humanities and Arts Category 1 breath requirement. Class is taught in 80 minute lectures twice a week. This class covers all aspects of linguistics. Professor Werner especially emphasizes the International Phonetic Alphabet. Homework is given once a week and it is usually very tedious, but it helps you understand the material well. This is because there are enough examples, such as converting words to its phonetic form and vice versa, that you are able to do these problems easily and quickly. Each homework has about 10 problems and does not take more than 2 hours to do. The grade in this class is determined by homeworks, a midterm, and a final exam. Going over the lecture slides and reviewing the book helps a lot in studying for these exams. Professor Werner is a great teacher. I would take this class only if you are really interested in linguistics, otherwise you will be bored.

Jessica Wu Class of 2009 (written June 2006)

82-202: (Modern Language) Intermediate French II

This class is the last French class to take that focuses mostly on developing grammar and vocabulary, so it is a good class to take if you have a good knowledge of French but want to strengthen your speaking and writing skills. This class is also a nice break from all of the CS and science classes. You can be placed into this class with either AP credit or you can take a short placement test on campus. In this class we presented on francophone countries, read "Un Papillon Dans La Cité", watched "La Haine", listened to French radio, surfed the web, had discussions and reviewed grammar exercises. This class required about 1 hour of work each week and there was 1 quiz the entire semester. Your grade in this class was based on your participation, your homework (i.e. if you turned it in) and your score on the final.

Aleata Hubbard Class of 2006 (written in May 2002)

85-102: (Psychology) Introduction to Psychology

The curriculum covers many topics in the broad field of psychology, but it also goes fairly in-depth for some of them. The specificity of the course ranges from the most basic level (interaction of nerve cells) to the most advanced (psychological disorders). Topics include sleeping, dreaming, the brain, the nervous and endocrine systems, motivation of behavior, learning as a process, the five senses, memory, development, aggression, and psychopathology.

There are three main sources of information: Two 80 minute lectures, one 50 minute recitation, and the text. Lecture consists of Dr. Kotovsky's mostly-well-organized oration of the details in addition to some in-class demonstrations, and contains about 250 students. Recitation, which is generally limited to less than 25 students in each, is mainly used to review the lectures and to deal with assignments, grading, and paper-presentations. The work consists of various weekly question-answering assignments (which take between one half to two hours a week) and a 5-7 page research paper on a topic of your choice (within the broad field of psychology). If you review the lecture notes on a regular basis and do all the assignments, you can expect to spend about an average of 3 to 4 hours per week doing work outside of class.

The tests consist of 10% material covered only in lecture, 5% material found only in the text, and 85% material found in both. The test questions are 75% short essay questions and 25% matching/multiple choice. Also, the third test includes information on three films presented outside of class. Unfortunately, the tests can be rather long and demanding (each short essay requires multiple pieces of information).

Your final grade consists of the final exam (20%), three in-lecture tests (12.5% each), a paper (12.5%), an assignments grade (15%), and the recitation grade (15%, but divided into quizzes (50%), attendance (30%), paper presentation (20%), and a bonus (up to 10%)).

Chris Yeung (written May 2002)