

Student Report for COMP_SCI_212-0_1: Mathematical Found of Comp Sci (Benjamin Golub)

Project Title: **Course and Teacher Evaluations CTEC Winter 2022**

Courses Audience: **110**
Responses Received: **93**
Response Ratio: **84.5%**

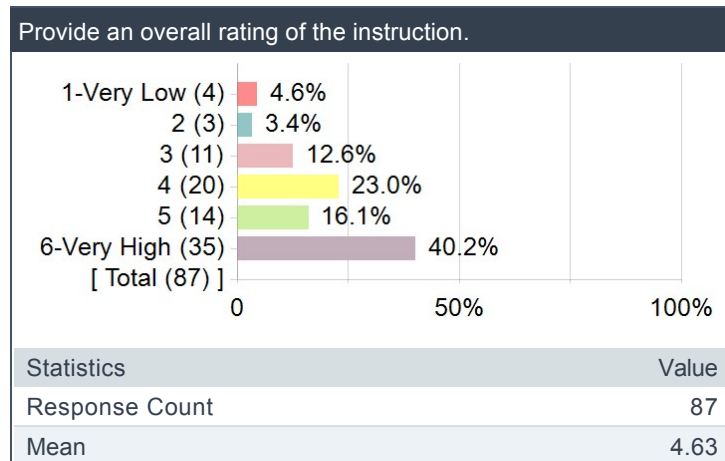
Report Comments

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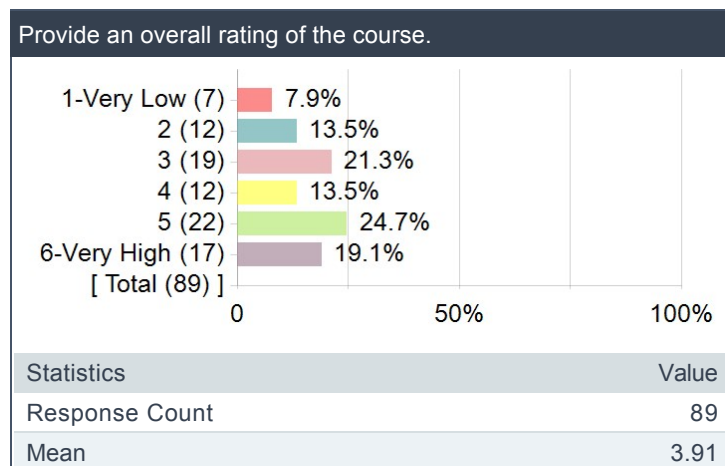
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COURSE QUESTIONS

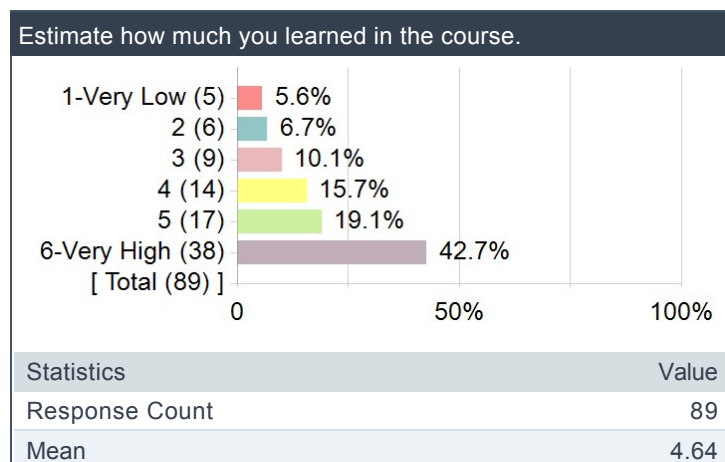
1. Provide an overall rating of the instruction.



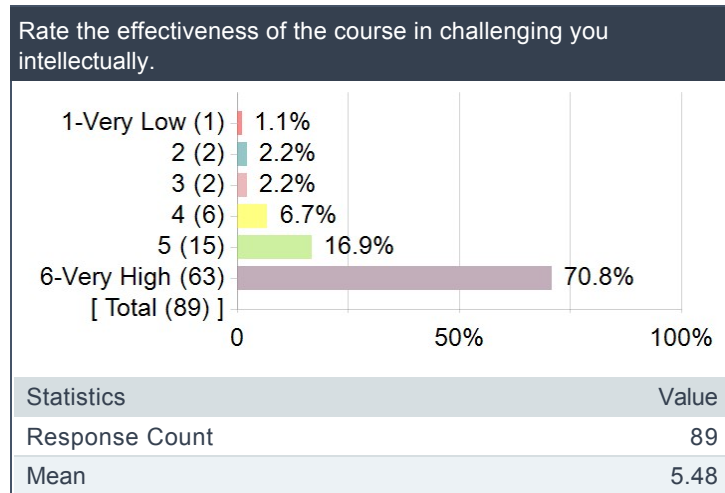
2. Provide an overall rating of the course.



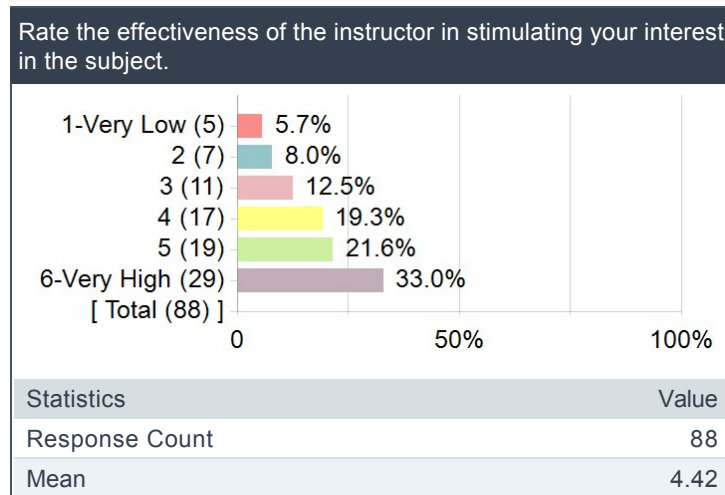
3. Estimate how much you learned in the course.



4. Rate the effectiveness of the course in challenging you intellectually.



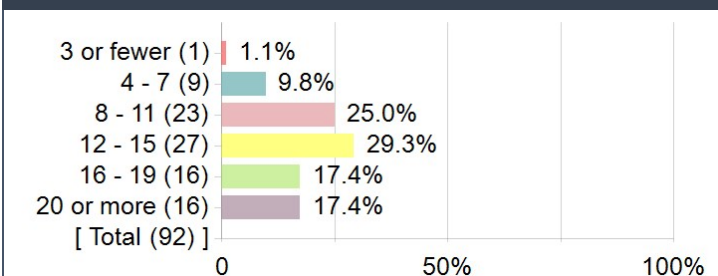
5. Rate the effectiveness of the instructor in stimulating your interest in the subject.



TIME-SURVEY QUESTION

6. Estimate the average number of hours per week you spent on this course outside of class and lab time.

Estimate the average number of hours per week you spent on this course outside of class and lab time.



| Options | Count | Percentage |
|------------|-------|------------|
| 3 or fewer | 1 | 1.1% |
| 4 - 7 | 9 | 9.8% |
| 8 - 11 | 23 | 25.0% |
| 12 - 15 | 27 | 29.3% |
| 16 - 19 | 16 | 17.4% |
| 20 or more | 16 | 17.4% |

ESSAY QUESTIONS

Please summarize your reaction to this course focusing on the aspects that were most important to you.

| Comments |
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| Problem sets can be long and difficult. Exams are hard. Seems standard for CS 212. Golub is an excellent lecturer. |
| This course is obviously hard but with enough effort and textbook reading it is manageable. Golub is a great professor who keeps you engaged during the entire class. |
| Very demanding and difficult class, but it's worth it, the math content is really interesting. Learning Overleaf is also worth it. Prof Golub is great. |
| Good lecturer, but exhausting to deal with. A lot of work, this iteration of 212 was much harder since the professor challenged the students more. That being said, if you can handle a difficult course, take it with Golub since you get a more rigorous training. |
| Rather difficult class, not sure it was any harder or easier than with any other professor, but I really liked Golub's teaching style. Going to class actually did help, which isn't always the case for classes like these. |
| This course was very difficult — However, it was also very interesting. Go to lecture! Professor Golub made this class the most interesting lecture class I have ever taken, he is extremely passionate about the material. |
| LOVED this class. It caused me so much pain and I am currently crying while writing this because I probably failed the final lol but it's also one of the best classes I've ever taken. The content is so interesting, and you really do leave with a good understanding of a lot of fundamental math concepts. |
| It is a huge time commitment though. This is by far the hardest iteration of 212 compared to other professors', both in terms of content and workload. Even as someone who's done proofs before, the PSETs took a solid 20 hours every week, and it was a struggle to even get 50s on the exams. The stress from this class probably took years off my life. |
| BUT I still really enjoyed the course overall. Like this class had me reading the textbook for fun because the material was actually so interesting to think about. Ben is also hands down one of my favorite professors here — he is genuinely such a sweet person and so enthusiastic about what he teaches. His lectures were always engaging and really made you excited to learn. |
| This is just a very very hard class and all of your free time is consumed by PSETs, but Ben is the best and you really do learn a lot of very cool things! I think if you can get through this class, you can do anything :) |
| This class is pretty difficult. There is a heavy curve on exams since the averages were pretty low. The problem sets are challenging and time consuming, but pretty interesting to think through. You are encouraged to type up answers to the problem set in LaTeX, which honestly ended up being the most time consuming part of completing them. I know many people who just handwrote answers and did fine. It is difficult to study for exams because of the conceptual nature of the class; you kind of have to go in just |

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| hoping that you learned enough through the problem sets. |
| This class was relatively difficult. However, Professor Golub was a good professor and the TA's and PM's really made the class doable. |
| I feel like one big thing for this class was that previous classes had a lot less work compared to us. Every question has at least abc, and sometimes d and e. This makes it really time consuming since we have to do 15–20 proofs per homework |
| Way too work intensive. I would recommend watching Albert Meyer's MIT lectures if available for whatever subject you are on. Golub's lectures consist of him giving examples and then never solving them, calling them practice (in addition to the problem sets and readings which take 10+ hrs a week). Good luck. |
| Very time consuming class. The course content was more interesting than I expected |
| If you have taken proof-based math classes before and enjoy math, the class might be okay for you. However, I don't think it really treats students who have never written proofs before fairly, and this is a large portion of the class. I've heard from friends that the class is easier with different profs, so maybe wait for a different quarter to take it if you're not very math-oriented. As a mathy person, the class was alright for me but the weekly problem sets did take a solid 3–4 hours of my time. |
| I learned how to think like a mathematician. |
| Professor Golub meant really well but this class could have gone a lot better. I understand that we're his first experience with this course, but there were constant errors and typos on the homeworks that would sometimes only be corrected a few days before they were due. There was constant miscommunication about grading (for example, repeatedly saying leading up to the midterm that a 70% would be an A with the rest as "bonus," but then actually making the cutoff for an A an 80%.) As a math major forced into taking this class for a CS degree, I also just think that there was a lot of disorganization in terms of material. At this point in the course, we're expected to draw from multiple textbooks in what we study and aren't given any definitions in lecture. This makes completing the problem sets extremely annoying, because on top of problems being assigned in different books, there are different definitions within each that, although not necessarily contradict one another, can confound so many concepts. This class was not enjoyable, and I didn't get much out of it. I hope this goes better for whatever group takes it next. |
| To be honest, I did learn a LOT in this class. However, this class took an insane amount of time outside of class. The problem sets each week got longer and longer despite him saying that it gets easier after the "trial by fire" problem set in week 3. At one point, we had a problem set where there was 5 questions but each question had subparts and the subparts themselves had subparts that were all proofs. Every week I am in misery because of the problem set and it consumes my entire life and soul. The exams are also quite brutal. For the class itself, Golub just sometimes gave up on Fridays and would post a sequence of Youtube videos? He would also get confused sometimes in the middle of class and then tell us something extremely questionable that he has to correct the following class. For the most part, he was an alright lecturer and this class has potential to be a good class with some adjustments (I would cut him some slack since this was his first time running this class). |
| The best class that I've taken in Northwestern so far. Prof Golub was very interactive and the content was very interesting. The problem sets take a lot of time but help you understand the lecture. Although it is definitely a hard class, it improved my thinking and problem solving skills a lot. Take it from Benjamin Golub if you can. |
| This class is very difficult and time consuming. The first part of the quarter was easy enough as it introduced the types of proofs and applying those to simple number theory examples, but the rest of the quarter ramps up exponentially when talking about matching, graphs, and probability spaces. The homeworks can take easily more than 15 hours per week, and office hours are essential. Golub is very passionate about the subject and will thus assign more problems/homeworks than the syllabus suggests. He loves his graphs so be prepared to see lots of problems related to those. Office hours and finding a collaborative group to work with are essential. |
| Take this class with Golub! It is definitely a lot of work but this class is tough with any instruction and Golub is a fantastic lecturer, super transparent and open with students, and not a very harsh grader, the curve for this class was actually pretty forgiving if you put in the work. Be prepared to sink in 8+ hours for each week's problem set if you want to get solid scores (and I say that as someone who is usually able to complete math homework very quickly, this class the time commitment is real unless you are already super familiar with proofs, set theory, graphs, etc). |
| I won't lie, this course was ridiculously hard. Professor Golub is a great lecturer to be certain, however, his homework is no joke. Even starting a day or two after the homework is released didn't feel like enough time, and I often spent upwards of fifteen hours on a single problem set, only to still feel dissatisfied with my answers. |
| Further, the exams were a bit difficult to me in terms of having enough time, they weren't as bad as a problem set yet they also felt like a lot to solve within an hour (the midterm) or two (the final). The singular saving grace of this class is that the professor has said that it is curved, however expect to cringe constantly at your numerical grade in Canvas. |
| It was a great course overall, mostly due to the part that Professor Golub is a genius. I loved his explanations in class, and he was a really amazing professor. This class was not easy at all, and the exams were difficult, but once we got through homework and exams, I felt rewarded. Definitely recommend taking the class with Professor Golub, and I mean it. |
| Really enjoyed this course. Professor Golub is great, and really wants everyone to do well and understand the material. This class shouldn't be too difficult if you've had prior exposure to proofs. |

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| I don't know if this is just how every discrete math/intro to math for CS course feels or not but I honestly didn't see how some of the material related to Computer Science. I've no doubt it does or else there would be no reason to teach it but I think it would be helpful to increase the focus on how particular ideas relate or can be applied to CS fundamentals or to programming. Otherwise it just feels like we're being taught a grab-bag of random mathematical concepts that we could easily pick up later in other courses as they become relevant (i.e. the purpose of the course is invalidated → the course seems useless → students lose motivation to actually learn the material). And if the point is just to teach us proof-writing/rigorous logic, then why not advertise it as such? |
| In terms of the actual course itself, I really liked Golub as an instructor; he seems very intelligent and was great at explaining the material. The TAs/PMs sometimes took a long time to grade or made grading errors but on the whole they were a helpful resource as well. The assignments seemed to be an appropriate difficulty and helped me understand the concepts better/prepared everyone well for the exams. On the whole I enjoyed the course and I think it was done well. |
| This class sucks. Too difficult and not well organized towards the end. I spent many hours on most problem sets and found myself needing to go to office hours often. Thankfully, the TAs were helpful and work was graded somewhat leniently. Professor Golub was sometimes nice but sometimes condescending. If you have never done proofs before and are not some math prodigy, good luck – this class was not the place to learn. |
| This is a very hard course. Every week I worked for hours on pset to get low scores. Do not take it with any other hard courses and make sure you're prepared for the difficulty level. |
| holy guacamole. This course with prof golub was insane. Ahhhhh. Homeworks are insanely hard. Lecture is too entertaining.... in all of the worst ways. Goodluck. Don't take this class if you don't have to, sorry cs degrees. The content was pretty good, I wish we didn't have to prove everything. Homeworks did NOT need to be that hard |
| Ben Golub is an interesting teacher. He definitely scared me at first, but over the quarter, my friends and I started to find his somewhat condescending attitude very charming and quirky, so class time was quite entertaining. However, he makes this class VERY hard. There are weekly homeworks that just take up so much time every week, so you have to start early and plan ahead. Also, we did no coding and the topics are very loosely related to CS. The TAs were usually very helpful, and we did well on homeworks even if it wasn't 100% perfect. I really think I would do much worse in the class if I didn't have friends in it, so if you're going to take it, make sure you have a solid group of people you can work with. All in all, Ben is an interesting guy and this class is super hard and you'll be happy to be done with it. |
| This course should be challenging, but it was too challenging and unfairly evaluated. The bulk (probably upwards of 15 hours per week) of our work went into figuring out problem sets that often required large leaps of intuition to finish, unexpected leaps we were never given the tools to make, and yet half of our final grade was comprised of exam scores in which we did the amount of work in about half a problem set (say, 5 hours of work normally) in the space of one or two. Speedy thinking was not something that the course taught, yet it was what we were tested on. The professor mentioned at one point in lecture that two of the following would be sufficient to pass the class: collaboration, time commitment, and previous aptitude in math classes (the last of which I have a big problem with, because a course should teach regardless of previous skill) – I put in all three of these and still majorly struggled on the midterm. |
| This class is as bad as people say it is. It's required for the CS major, so have a good group of friends to take it with — you'll definitely need to rely on each other. Unless you really really love math, this is absurdly difficult and confusing. Professor Golub is a super interesting teacher... he absolutely wants to see his students succeed, and is always willing to answer questions, but sometimes just does so in a weird way. He's absolutely a genius, and definitely became entertaining as the term went on. In the beginning of the class though, he seemed a bit cold, but we started to like him. I do think he made the class more difficult than other quarters though, so definitely consider that. |
| Undoubtedly the hardest class in the CS 200-level intro sequence by far. You have to put a lot of thought and creativity in order to solve problem sets. Problem sets are a massive time sink and usually take me at least 6–8 hours of intense work to do. Problem sets are doable though, moreso if you go to office hours and have a good group to work with. This class was definitely the hardest class I've taken but I really enjoyed how intellectually challenging it was. |
| Golub did a pretty good job teaching, but sometimes he seemed unprepared for lecture and would trip up and confuse people with his notation. From what I've heard though he made this class harder than previous professors. Sometimes Golub can be pretty intimidating and really likes to passive aggressively get people to participate in class. |
| If you do not have to take this course, you absolutely should never take it. If you have to take this course, you absolutely should not take it with Benjamin Golub. The material was unnecessarily difficult to the point that the TAs were having trouble explaining how to approach it. The professor is often confused during lectures and explains the same concept 3 different ways before settling on how he wants us to interpret a certain context. He often needs student help to complete the problem he constructs himself. The exams are graded in an extremely harsh manner, with points being docked for no apparent reason. The problem sets are by far the worst part, taking at least 12–15 hours a week to complete on their own. |
| Ben Golub is the GOAT. I learned so much in this class and just overall am much better at reasoning rigorously. |
| I've never taken a class at Northwestern where I felt like you had to be inherently talented at something to succeed – if you put in the work necessary, you can get an A. This was the first class where I didn't feel that way. In fact, Golub said this himself. To do well in this class, you can choose 2 of 3: spend excessive time, possess very good math skills, or be part of a great collaborative group. |

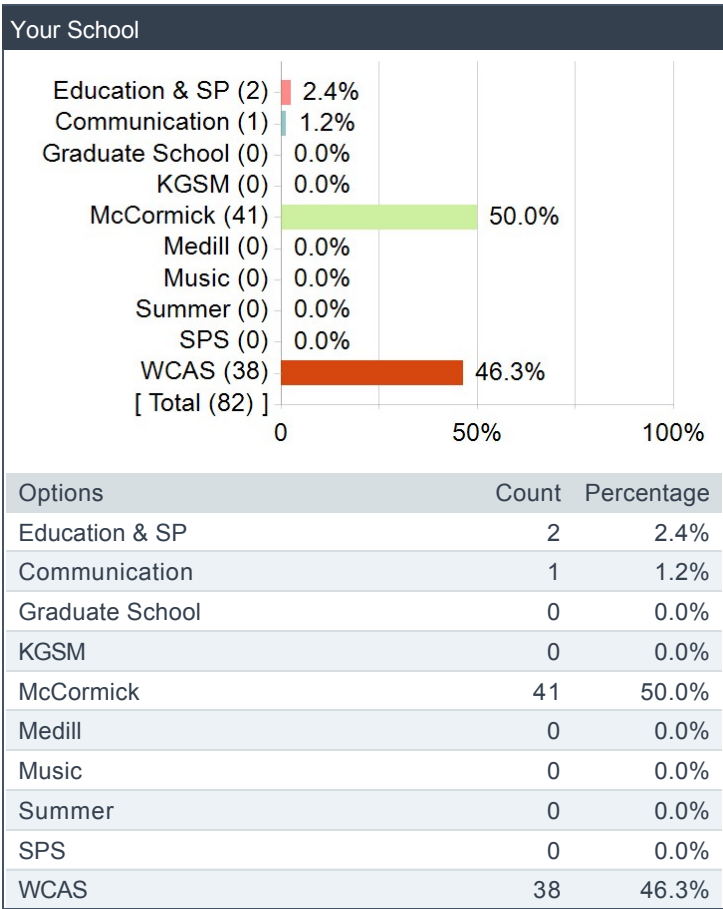
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| <p>The problem sets were very not great. Before I had a collaborative group, I was averaging 15 hours per problem set (keep in mind that I've taken AP Calc, MATH 220-2, 230-1 and 240 and did decent in them, but I don't have a strong math background). Golub told us that even he and the TAs themselves struggle to do the problems. So then why would he assign them to us, the world will never know.</p> |
| <p>Don't take this class with Golub. Pros: uses a textbook, good with tech (Panopto, Piazza, knows how to use Zoom), midterm was very reasonable. Cons: textbook isn't that great (practice problems with no solutions, some of the proofs/explanations aren't thorough, no physical copy), lectures were often disorganized (he spent an entire class trying to explain the answer key for a problem set question, confused himself, and then called it a day; many times, he didn't really seem to know what was happening... like he was just writing down stuff and seeing how it would turn out... as if the answer would surprise him too). Taking this class with Golub was SIGNIFICANTLY harder than with other profs and covered more topics.</p> |
| <p>My advice: take this class with friends. Smart friends. Take it before 214, since some of the content overlaps (e.g. graphs). Don't take it with Golub unless you (1) have a strong background and intuition for math (2) genuinely want to learn discrete math. If you are like me, just getting this requirement out of the way, put it off for later. Taking 212 is helpful, but isn't necessary for a career in computer science.</p> |
| <p>This class is challenging. The amount of time and thought that goes into every homework assignment is a massive commitment. Sometimes this class will cause you emotional pain. With that said, I really enjoyed it. There are concepts that I've never seen before that I really loved and lecture is amusing. Prof. Golub is a literal genius and he expects a TON from his students but he never fails to entertain and explain really hard concepts in the most seamless ways.</p> |
| <p>While I did enjoy covering the material in the course, I would recommend against taking this course with Professor Golub. Don't get me wrong, I like his lectures and I think he teach well overall. However, the assignments he gives are insane compared to other cs212 professors. Most people spent 15+ hours on most assignments because of their insane difficulty compared to the concepts taught. Unless you have a decent background in proofs already, the assignments will be near impossible to complete by yourself and even with a group it is difficult. The exams were overall ok, still difficult but reasonable in my opinion.</p> |
| <p>If the content of this course was not already challenging, the weekly problem sets were borderline absurd. I do not know of a single person who was able to complete these accurately and fully without going to office hours or working with other people. The exams (or at least the midterm) was not so bad at reflecting what we learned until then. The problem sets, however, were always very hard to complete and always took upwards of 15 hours per week. I really thought that people were exaggerating about cs212 being rough, and regarding the content I did feel this was the case, but the workload was crazy.</p> |
| <p>I would not recommend taking this class with Prof. Golub. I know for a fact the class was exponentially harder than the previous quarters. The homework was unreasonable and the amount of topics covered was unreasonable. He attempted to cover the same amount of math as a math class here does in one quarter, in a few classes, which clearly doesn't work. As a math major I'm not new to proofs, but I felt as if this course emphasized the wrong aspects of them, and the exams (which end up being most of your grade even though the homework takes hours) are heavily multiple choice based despite the focus on proofs.</p> |
| <p>I found this course to be frustrating because, for the type of computer science I'd like to pursue in my career, it felt rather pointless. The problem sets were challenging but doable and the grading is fair with a curve.</p> |
| <p>I recommend that you don't take this class with Prof. Golub. The homeworks were extremely difficult. I didn't learn anything out of the homework because I couldn't do them on my own without my partners. By far the hardest class I've taken in my life.</p> |
| <p>This course was intellectually challenging and it was the hardest course I have ever taken.</p> |
| <p>While a challenging class, it is also very interesting and engaging. The instructors do an excellent job explaining the material, and, given adequate work outside of the class, it is easy to succeed.</p> |
| <p>This course is very challenging at the first half, but you still learn interesting concepts despite the degree of difficulty.</p> |
| <p>This class is so hard. I would be consistently spending 15+ hours per week on problem sets, only to still not feel that confident in my answers. It really felt like I was being thrown off the deep end every single time we learned something new. That being said, writing proofs is something you can only really get better at with practice and time. I have surprised myself at how far I have come from the beginning. This is a challenging class, but can be really rewarding if you put in the effort.</p> |
| <p>The material was very difficult but Professor Golub was great. Very time intensive problem sets.</p> |
| <p>Problem sets were very much impossible</p> |
| <p>Professor Golub took some time to grow on me but I ended up really liking him. The content is very challenging but Prof Golub is extremely knowledgeable and able to assist at all points and is very good at answering questions. It can be intimidating because he is clearly very smart but if you ask questions he is very helpful. The class is challenging due to the nature of the work but it is doable. Collaboration is extremely important.</p> |
| <p>Prof. Golub was an incredible teacher. It was obvious that he cared for his students and that they not only were provided with a rigorous base of knowledge which will prepare us for further mathematical studies, but also that we retain (or gain) an excitement for the possible applications of the math we are learning. He can be a bit intimidating, but I thoroughly enjoyed his class and hope</p> |

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| to take more classes with him in the future! |
| This class is very hard. Office hours were not that helpful, the only way to get through this class is to have a good group that you can collaborate with on the problem sets. Good luck! |
| This class awakened a new desire in me to study mathematics. It was a challenging class, but not an unfair one. If you enjoy proof-based math, this class is a great way to explore discrete mathematics. If not, the first few weeks are a true "trial by fire". Professor Golub is an engaging professor that is genuinely committed to having students puzzle out the answers with some help rather than spoon-feeding theorems. |
| Overall not that bad especially if you've done probability and proof based math courses. Golub is a great lecturer but his notes are a bit disorganized so you really need to listen in class. Midterms and finals are difficult but have a massive curve. Overall didn't have to do much studying. Same case with the homework. They are unreasonably difficult but again 80% is an A in the class. So TLDR, time consuming class but easy A. |
| <p>This class is so very very hard. I already had an idea of what to expect coming into this class but did not expect it to be so overwhelming. This guy is definitely harder than Rao or Vijayaraghavan. It's very obvious the professor wants students to learn and gives them extremely difficult and time consuming assignments. It came to the point where I would dedicate three full afternoons/evenings to work on the assignments with my partner. The class starts out very intense, laxes a bit in the middle, and then picks up the intensity at the end.</p> <p>Towards the end of the quarter, it felt like a lot of students were mentally checked out because of the difficulty of the homeworks. The only way to do good on the homeworks is to either be extremely smart, have smart groupmates, or go to office hours a ton. This class' workload ended up equaling my total courseload for my three other classes. I This class was always at the back of my mind. I would not take it with him again if I could. I understand he makes the assignments difficult for us to learn, but it came to the point they were so difficult we were more focused on getting the answer than actually understanding the solution. The exams weren't as hard as the homeworks but the averages were relatively low.</p> <p>Also, the prof can be funny and sarcastic sometimes in a funny way and engages the class by encouraging discussion, but then there are times he says stuff like 'this should be very easy' or 'this is very trivial' even though it may not be. He is from Harvard and NU is definitely a step down, but his attitude irked me as well. The Jesse Tov of 212 has arrived.</p> |
| <p>After having taken all the CS 200 level courses, my ranking from most difficult to least is 212, 211, 213, 214.</p> <p>Overall, terribly difficult class and made my quarter miserable.</p> |
| This class is so hard, that I don't think I fully learned anything. Definitely take with a friend or someone you know is smart, and study well in advance for midterm/final |
| <p>This course is HARD, but that will be true regardless of the professor you take it with. Homeworks take forever to complete. Sometimes, you could spend the entire week working on the problem set and going to office hours with no guarantee that you'd understand or finish by the end of it. Professor Golub is very clearly smart and does his best to engage with students during class, but sometimes he's difficult to understand. I've definitely (among other students) walked out of lectures thinking "wow I have no idea what he just talked about." The instructional team kinda disappeared towards the end of the class (no Piazza posts were answered for like an entire week straight.) My only advice is to do the homework ahead of time. Start as early as possible!</p> |
| <p>This course was very difficult for me, as this was my first exposure to rigorous proof-based math and most of the concepts in the course. Though I did not have high expectations for my performance grade-wise, I think that I overall gained a lot from taking this course in terms of problem-solving skills. Professor Golub also somehow presented math in a really interesting and application-based way, and I gained a better appreciation of the role of math in helping us understand deeper truths about the world. Unlike other math classes, the course didn't seem like trivial manipulation of numbers.</p> |
| <p>The problem sets were difficult and a time commitment, but in retrospect caused me to more deeply understand the material that I otherwise would. Definitely more than for other courses. I would recommend finding a good partner(s) to do the homework with to alleviate the time and frustration of solving the problems alone. TA/PM office hours were also very helpful.</p> |
| <p>The course with Prof. Golub was challenging and required a lot of time, effort, and patience. I did get a lot out of the class. The problem sets required too much time in some cases and at times the class environment was not the nicest.</p> |
| <p>Really hard class, learnt a lot of mathematical concepts but there seemed to be a lot of workload which could have definitely been reduced for the students. Class was overall well organized however it felt like too much pressure even though I always tried to finish my work and assignments on time. Final grades wouldve been more representative of knowledge if the exams were weighed less.</p> |
| <p>The professor made this class really unenjoyable. We were expected to combine concepts that we barely had a chance to learn.</p> |
| <p>This is a very tough class. Ben does a somewhat decent job at explaining concepts, but this class lacks structure. The psets took a LONG time. like upwards of 15-20 hours. The exams were tough. Honestly everything about this class was just very hard. The one good thing about this class is that it's actually pretty interesting, and this is coming from someone who has never had any experience with proofs or any previous interest in the subject. Other than that, it's just a hard class.</p> |
| <p>This class was amazing, my favorite class at Northwestern so far. I feel like this class taught me a new way to problem solve. Ben did a great job of challenging us, and I learned a lot because of it.</p> |
| <p>To be fair, you have to be mathematically inclined to succeed in Golub's Mathematics for Computer Science. The concepts are</p> |

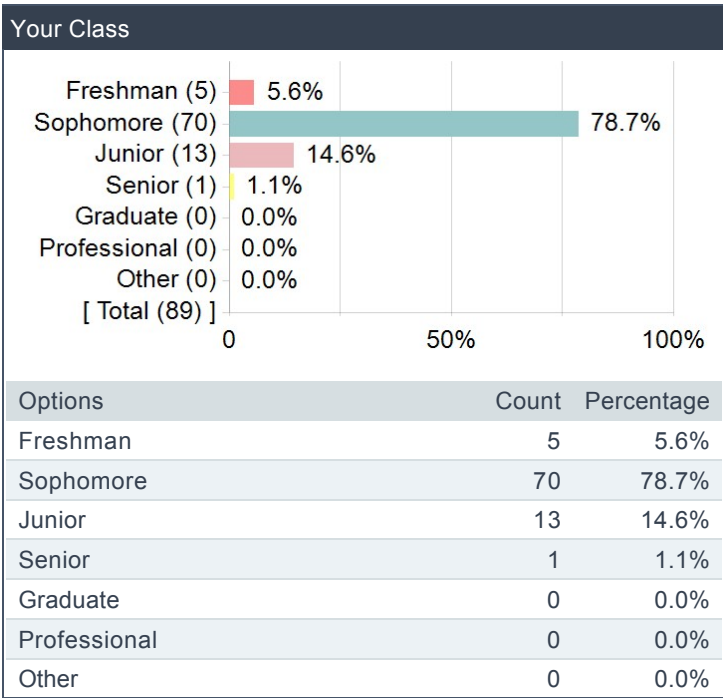
| Comments |
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| extremely subtle, and without a solid grasp of Proof by Induction, the Pigeonhole Problem, and Polya's How To Solve It (1945), most of the lectures (which are very good) will go over a typical student's head. There's also Golub's nihilistic outlook on the rote repetition of modern mathematics education and his perceived endorsement of difficulty and discouragement as part of the learning process, which is deftly woven into his inscrutable, labyrinthine 20-question weekly problem sets that seem to befuddle and frustrate as much as they teach — the term "sink or swim" comes to mind. As a consequence, those unprepared for CS212 will find little to enjoy — being saddled with three other classes and concerns about summer employment, of course they won't pick up on the sliver of encouragement in Golub's admonitory catchphrase "We're not children anymore" (which in retrospect was also a cryptic reference to 0-degree graphs). Looking about LR2 every week, I couldn't help but commiserate with the visibly confused. Golub's 212 is not for the unprepared, and it's definitely not to be experienced alone — make sure you find a study group, or at the very least have the TAs/PMs on speed dial. If I was working by myself I would have dropped in the first week. |
| You will learn a lot in this course if you try a lot but the hw's were kind of ridiculously demanding and long. Quite time consuming and annoying |
| This course made me go to therapy. |

DEMOGRAPHICS

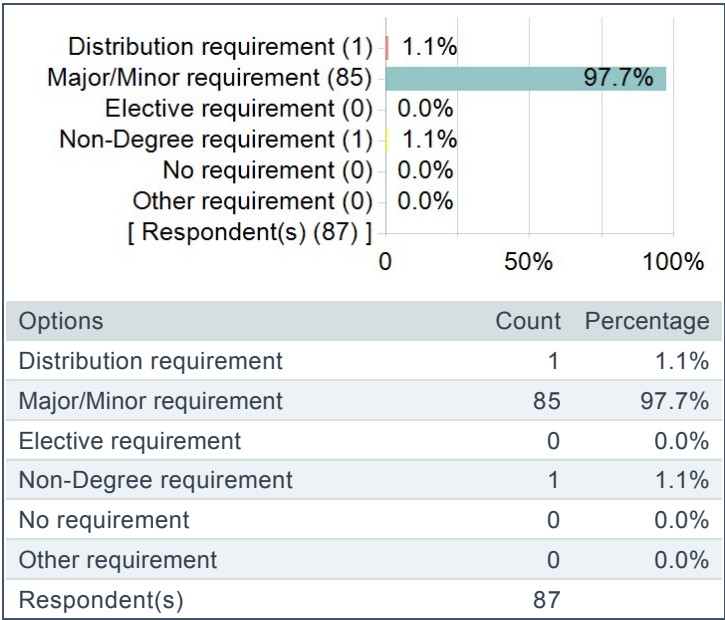
What is the name of your school?



Your Class



What is your reason for taking the course? (mark all that apply)



What was your Interest in this subject before taking the course?

