How-to Comp Sci at Stuy

Abstract

Since computer science is very different from most of the classes you have previously taken, it may require you to use alternate study strategies to learn properly. Some math classes teach you how to perform a task, then ask you to perform that same task on an exam with different numbers. We do not do that. Instead we teach you some tools, then you have to learn to solve problems with those tools. You will be tested on problems that use the same tools, but on many of the exams, you will encounter a problem that you have not seen before that can be solved with the same tools.

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Why homework?

In fifth grade, math homework typically involves many repetitions of similar problems. Students can learn by repeating similar work until patterns become obvious. Each problem requires only a minute to solve.

That model fails in problem-solving courses like this one, where the problems are larger. You can no longer rely on absorbing a pattern through repetition. Instead, be more thoughtful about the problems. Do the significant work that can be required to understand the question. In fact, understanding the problem will most likely be the most time consuming process in working on homework. However it can easily take 10 or 15 minutes to write a program that solves said problem, test it to find errors, and fix those errors.

For many successful students, concentrating on a few problems requires a conscious, significant change in their approach to homework, and requires a conscious divergence from established work habits that have proven successful for them. The good news is that the new work habits will contribute to success in future courses on problem solving, both in high school and college.

Homework is the principal road to learning computer programming.

Do it.

Doing it early affords the opportunity to ask questions before it is due, and provides a time cushion when an assignment takes longer than you expect. Doing homework late—although it impacts grades—is far, far more educational than skipping it. Doing it late after we have gone over it in class is *still* more educational than not doing it.

Just do it.

Homework requires an average of one half hour per day for a typical student, less for a student with experience in programming, but more for a student who is struggling or catching up.

How to homework?

Struggle solo with the solutions, rather than immediately asking for assistance. Write down questions that occur to you, and *take the initiative and responsibility to seek answers* (read section on seeking answers below).

There are four key elements to doing homework completely and correctly. These apply to many courses in high school and college:

- **Struggle solo** with a problem. When confronted by something they don't understand, beginning programmers should struggle on their own for at least 10 minutes, which initially feels like a very long time. More experienced programmers spend longer on their own, perhaps half an hour. But the best programmers seek help eventually; that helps make them the best.
- **Seek help but not answers** for problems that remain.
- **Incorporate help** to produce correct results. This means returning to "struggle solo", but armed with more knowledge.
- **Compare** your work with teacher or peer solutions, after you are done with creating your own. Otherwise all you can say about a problem is "I did something which *may* be

correct" or "I am ignorant on how to do it". Learning requires being able to assert "I know one or more ways to get the correct answer." That assertion is justified only by comparison with others' results. Understanding solutions by a teacher—or any other programmer—frequently requires returning to "seek help", since another programmer's solution can be very difficult to understand, even when that programmer thinks it is clear.

Keeping up is easier than catching up

Keeping up with homework assignments is challenging but crucial in computer science courses, for several reasons:

- Undone homework piles up. Many students find it challenging to fit each day's homework into full or over-full schedules, and skipping a day doubles the problem. Longer delays are many times worse.
- It is in doing homework that students actually learn the material presented in a day's class. The longer the delay between the presentation of the material and the homework, the less you remember from the class. It is easier to do Monday's homework at 4 pm than 11 pm. It is easier to do Friday's homework on Friday than on Sunday. Delays make homework harder.
- This course is cumulative. Understanding today's topic depends on your having learned previous classes' material, by doing the associated homework. Without that learning, succeeding classes can be worse than worthless to you, because they confuse you instead of teaching you. As time goes said confusion increases exponentially.

"My computer (or internet connection) broke, so I can't do the homework."

From the point of view of keeping up with the homework, a broken computer provides no relief from the problems of falling behind. Students must find a way to keep up. Here are some strategies:

- Do the homework with a classmate, on their computer. It is usually more educational and often more fun to work with a friend, even when your computer works. Of course, if you work with someone else on the homework, you must cite that cooperation in your submissions.
- Share a computer with a family member. Most homework requires only a browser. If you work out a plan for your solution before approaching the machine you will only need a browser for no longer than 10-15 min. There are online code editors for Scheme, NetLogo and Python.
- Go to the CS Dojo, where there are plenty of computers. Bring a pair of headphones if the homework requires listening to Mr. Brooks's videos.
- Do the homework by hand on paper and test it when you get a hold of a computer.

Whatever approach you take, rise to the challenge of keeping up while repairing your computer.

A broken internet connection requires similar thinking. You can use a computer at school, including those in the library and CS Dojo. You can submit homework by carrying it to school on a USB drive and submitting it from school.

How to succeed in this course

Understand the homework

Students succeed in this course by understanding the homework. Whether you judge success by mastery of the course material, or judge success by grades, understanding the homework is apparently required. To acquire that understanding, you must practice the thinking, look for patterns, find your errors, and revise erroneous attempts. Homework exercises all of these those.

It would be great to gain the understanding with less work, since the aim is learning, not homework. So students are encouraged to recommend study techniques they find effective, and to advise against ones they find ineffective. Perhaps the mostly widely-successful strategy is working with a classmate.

Understanding homework requires more than just attempting homework.

- A correct-looking solution that has not been tested is almost certainly wrong.
- Compare your solutions to others'; We usually go over solutions in class after it is due. Reading others' solutions *routinely* teaches ideas that would not necessarily occur otherwise.
- If you are stumped by a problem, seek help, and then do the problem on your own, without help.

Take GOOD notes

At this point you are probably used to copying down the AIM and the Do Now at the beginning of every class. Try to change this approach. First read the said Aim and DN prompts. Do they look informative? Do they call for action? Often time the DN calls for action, so focus on the action of completing the task instead of copying the DN to your notebook. By the time you are done copying, every one else will be done with the actual task at hand.

Taking notes during the rest of the class requires a similar approach.

Things to copy from the board:

- shorthand notation for syntax and new primitives
- useful syntax constructs (why is that useful?)
- tips (organizational or technical)
- description of code and description of different solutions to problems presented in class

Things to avoid copying from the board:

- Code
- Do Now task description

Most importantly **COLORCODE**!!

Keep up

It is easier to keep up than catch up. If you miss a class or are confused by a class, take remedial action quickly. The "notes from class" can augment or correct your recollection of what you heard in class. Classmates can explain their notes, and those classmates will learn more by explaining. If you don't understand the notes, that confusion provides a starting point for questions.

Recommendation: work with a classmate

Working on the homework with another student can help significantly. Here is why:

- Working with another fosters questions and answers. Verbalizing questions and answers fosters the hard thinking that is necessary for learning.
- Some people think more productively in company (see especially the last point in this discussion)
- The discipline of working with another person supplements the self discipline required to work alone. It is far easier to make an appointment with a classmate to work together, ideally at the CS Dojo. Then your natural politeness and disinclination to abandon an appointment will augment your self discipline.
- For those of us who enjoy teamwork, working with others is more fun than working solo. Fun is a rare commodity in homework.
- For those of us who prefer working solo, there are in fact other people in the world, and throughout your life you're going to have to work with these other people at times. The tech industry is at its best when people collaborate, and part of our job is to model these best practices. This is a great chance for you to work on your group skills, while still being given the opportunity to work alone at times.

In this course you are strongly encouraged to experiment and improve at working in pairs.

Some caveats:

- "Working on" homework is not the same as "copying" homework. Copying involves no thinking and helps little in computer science courses.
- Academic honesty requires that you understand and be able to explain your submissions, and that you identify sources of help. For example, it is always a pleasure to read comments like "I worked with Brian Kernighan on this problem, and I completely understand the results." Submitting another's work without giving credit is cheating. If you are still unsure about the boundaries between working together and copying, please familiarize yourself with the Academic Dishonesty section of this document.

Academic Dishonesty Explained

THIS IS NOT ACADEMIC DISHONESTY:

- A student submitting original work done alone or with the help of the instructor.
- Students solving as a group a problem in which group work is permitted, and identifying each member of the group when submitting the assignment.

- Students discussing the intention, as opposed to the solution method, of a problem. (e.g. discussing which methods to use, what tools are needed, how to approach the problem)
- Students discussing the concepts/tools related to the assignments, **without using the assignment itself as an example.**
- Students discussing course material for the sake of understanding. **However, as a general rule, such discussion becomes suspect as soon as any notes are taken that can be directly incorporated into an assignment**.

THIS IS ACADEMIC DISHONESTY:

- A student submitting someone else's work, or a modification of that work, with or without that person's knowledge, regardless of the circumstances under which it was obtained, copied, or modified.
- A student allowing someone else to submit the student's work, or a modification of that work.
- Students solving as a group a problem in which group work is prohibited, and submitting multiple copies, each as individual work.
- A student using someone else's work, including segments of permitted program libraries, without proper attribution.

THIS IS SEVERE ACADEMIC DISHONESTY:

- A student using another student's work without the latter's consent or collaboration.
- A student contracting course work out to others.
- A student planning or executing with another student a cooperative subterfuge during an exam.
- A student obtaining any privileged course-related information from any instructors' accounts.
- A student lying or failing to give full cooperation to the instructor or the AP's during an investigation of dishonesty.
- A student making use of unauthorized material during an exam.

Good students seek help

Too many Stuy students have acquired a wrong impression about seeking help, perhaps because middle school was easy for them. In better high schools and colleges, good students seek help; weak students don't. When I visit the Comp Sci Dojo (see below), I usually recognize students there who are among the best in their classes, working in an environment that they have found fun and conducive to success. Try it.
Know these sources of help:
0. ***IMPORTANT*** This CS course most likely uses a specialized web site such as Google Classroom or Piazza that has proved a tremendously successful forum in which students **post and answer questions**, without the need to coordinate a meeting with someone else. Check it out!
1. You can generally find your teacher in room 301 when he/she is not teaching. You can [really should] make an appointment via email. Politeness requires keeping your appointments, or—second best—alerting your teacher in advance by calling extension 3013 if you intend to break an appointment.
2. Your classmates have thought about and possibly solved the issues you face. Boost the community by **posing or answering questions**; both help.

3. The **Comp Sci Dojo** meets four times weekly after school, with successful comp sci students offering help and an environment conducive to doing comp sci homework. It is scheduled for **every Monday through Thursday in room 307, from 3:40-4:40**. Bring a homework problem or test that displays your confusion. Even better, bring a classmate; both of you will learn more by working together, with your work augmented by occasional help from the Sensei or their Senpai assistants. The CS Dojo is a weak resource for learning what transpired in class; use another source of help for that. There are usually Senpai and Sensei hanging around at the Dojo, **grab one** and take him to the station at which you are working, **ask them questions**, **they know a lot**.

If you are absent from class, seeking help is necessary. The best way to catch up is to sit with another student from your class to go over their notes, while taking notes yourself. Both of you are likely to benefit; a person who teaches learns from the process, clarifying their own thinking.

Class participation

Asking questions or proposing answers in class helps the askers and answerers. Asking helps askers because they do the hard thinking necessary to identify misunderstandings. Answering helps answerers because they do the hard thinking necessary to verbalizing their understanding. In addition, participating helps practitioners stay engaged with the class. Many students are initially reluctant to reveal their confusion. Bear in mind that if you are confused, there is a high chance that someone else in the class has the exact same problem/question. Help out by bringing that problem/question to your teacher's attention.

Grades

Grades for this course are calculated **almost** entirely from grades on tests, final project and the final exam.

Tests

Tests aim to answer the question "Did you understand the homework?" To that end, test problems resemble homework problems. Students who do the homework and review it before a test have the relatively easy task of recalling their thinking. By contrast, students who skipped struggling with the problem as homework face an unusually tough challenge on the test.

Things that don't work:

1. Reading your notes and previous solutions is **not enough** to do well. This helps you remember some of the tools you need, but won't help you learn to solve problems.
2. Doing a multi night problem set on the last night means you will not be able to ask questions or get hints. You will get stuck, frustrated, and burnt out.

Things that do work:

1. Get sleep early the night before your exams. You cannot solve problems when you are sleep deprived. This class is **not** about memorization and recollection, you really do need sleep.
2. Do more practice problems and test your solutions. Also you can try to redo old problems that you know the solutions for.

3. Getting help from others when you are stuck on problem sets. There are many forms of help you should seek out, you do not have to get stuck on a problem for hours.
4. Reading the questions/answers to problems on the class mailing list/discussion board.

Understanding and revising test grades

Students are encouraged to figure out how they erred on tests. The teacher should be the last resource that a student turns to when trying to correct his/her test answers. In particular, do not ask a teacher to identify your error or justify their scoring as soon as you receive your test. Instead, re-read the problem, consult classmates if necessary.

If you are sure that the teacher made an error in grading, within 2 school days of the publication of the test and rubric, write a paragraph explaining the alleged error. Resubmit the test to your instructor, with the explanation. The whole test will be re-graded. All grading errors found in that process will be corrected, so as a result **your grade may go up or down**.

Final Project

The purpose of the final project is to showcase your skills, creativity and demo what you learned in class and on your own (if you took a chance to explore on your own). Projects are rated individually based on their functionality and content. Your final project grade will be based on the criteria provided by the teacher and the quality of your work.

Calculating the grade

Calculating course grades from test grades has advantages over more subjective measures:

- It removes the incentive to copy homework, since one cannot earn a high grade by submitting copied programs. On the contrary, copying homework instead of helping it hurts grades.
- Neither students nor the teacher worry about playing favorites, nor harboring grudges.
- Class participation has little direct impact on grades. So students can earn high grades even if they are disinclined to volunteer in class. As discussed, participation helps everyone, but if you can maintain engagement with the class without volunteering, your grade will not suffer.

Students are not judged based on their grades. Teachers derive no job satisfaction from grades. There are always people who earn high grades, and there are always people who skip the homework and fail. There is little variation in the class averages between semesters. This handy guide is here to help you avoid some of the mistakes and frustrations that tend to arise when students take a CS course for the first time and we are confident and hopeful that you will take the opportunity to learn from it and you will do great in this course.

How to e-mail

Telepathy is a rare ability, therefore other means of communication are necessary. Email! Use standard English, full sentences, verbs, paragraphs, courtesy, organized thoughts, re-reading, revision, spell-checking, and all the other tricks you know for communicating effectively.
Put some meaning into the subject field! Indicate content and purpose. A subject like "help!" is useless; it tells the reader nothing except that the author is too lazy to help the reader understand the issue. Expect bad results from telling the reader that.
Send your email to the appropriate address **indicated on the instructor's class page**.
The first sentence of your email should tell the reader why you are writing or what you want. It should answer the reader's implicit question, "Why should I make the large effort to understand the rest of this email?"
In subsequent paragraphs, provide background, explanation, or amplification.

Classroom routines

Students who plan to miss a class can ask permission to attend one of the other classes their instructor is teaching that day. We cannot have unlimited switching, because overloading a period reduces the attention a teacher can give individuals.

start of class

Your objective at the start of each class is to create as quickly as possible a mental and physical state in which you are ready to contribute and learn. There are 3 elements:

- Readiness to make notes requires starting a new page in your notebook with the day's date, and having 2 writing utensils of different colors on the table.
- Stow all other belongings under the table, clearing the aisle between tables.
- Mental readiness is fostered by the completing the assignment, which is projected or written on the whiteboard.

Start the do-now assignment by the time the late bell rings. Most sophomores have assimilated this timing. If your do-now assignment requires/allows collaborating with a neighbor make sure to do so. By this stage in your scholastic career you know the appropriate voice level for group work. As a rule of thumb, if your voice can be distinguished by the teacher over your colleagues', you are too loud. Learn to murmur.

Start-of-class routines typically finish within 3 minutes of the late bell, depending on the opening assignment. Four minutes represents 10% of the class time, so you can appreciate the need for discipline.
If you need individual attention — for example, to add a signature to an absence note, leave it on teacher's desk before the class starts. Sometimes your instructor can also talk after periods **when he/she is not preparing to teach in the next period**. Individual concerns can not be

addressed before classes. At that time your instructor is trying to start the class as speedily as possible. Devote your time before class to the do-now exercise.

lateness

If you enter the class after the late bell, leave any late passes on the teacher's desk. Naturally, good manners dictate that late arrivers seat themselves and catch up quietly, disturbing the class as little as possible.
If your teacher in the previous class is keeping you from arriving at this class on time, do the adult thing: talk to the teacher. There is no substitute for talking to someone when there is an issue. You can present your obligation to be on time for this class, and any adherent to the Golden Rule is likely to be sympathetic. If that discussion is fruitless, please talk to your CS instructor. Communication helps.

during a presentation by a student

Presentations by students require heightened manners, since students are often little-used to presenting. If you arrive late while a student is talking, remain unobtrusive just inside the door, until the presentation is over.

bathroom

As John Bruestle aphorized, "You cannot program when you have to go the the bathroom." But no one wants to raise a hand during a discussion, wait to be called on, only to ask to be excused. Instead, if your instructor sees you gesturing pointedly toward the door, he/she can respond non-verbally without interrupting the class.
You may **not** visit the bathroom:

- in the middle of taking a test. That is, to use the bathroom during a test, you must hand all your papers and acknowledge that you are done with the test, since you will not be allowed to resume taking the test. So good test-taking practice is to consider using the bathroom before class begins.
- during the do-now

Absence

yours

When you return from an absence, show your instructor the standard form for absences or lateness (search the Stuy site for *absent*), signed by a parent or guardian, indicating that they knew of your absence. Similarly, if you are on a trip with a team or another class, you need a documented hand-off of responsibility to the trip's adult leaders.

When you are absent, it is your responsibility to catch up. The usual sources of help (listed above) can help.
When your absence results in your missing a test in this class, your responsibility has several parts:

- **E-mail your instructor** prior to missing a test (if possible) with reasons for missing said test and times that you would be able to make up the test on your first day back to school. Delays in your taking the assessment slow everyone else's learning, since you delay the opportunity to post the questions or discuss them in class. If you delay scheduling a make-up test, solutions may be publicized, which precludes your taking the test..
- Avoid listening to others talk about the content of the test, since others took the test without advance knowledge of the questions.

instructor's

When the instructor is absent, he/she usually posts instructions in the class notes/assignments section of the class website. Look there.

Etiquette

etiquette and independent learning

Everyone is welcome to learn extra stuff on their own, and to use it on homework or tests.It is one of the great aspects of computer courses is that you can learn any amount more on your own, and benefit from it, whether the amount is small or large. Every semester there are a handful of students whose interest in the material leads them on, and it is a pleasure to see. Our only request on this subject is that you not ask for support on extra stuff in public forums, thereby spending scarce resources like time on digressions that hurt — rather than benefit — the class as a whole. This request applies to questions in class and on Piazza or Google Classroom. Independent learning is great, as long as it is, well, independent.
This kind of self-restraint is tougher than it sounds, since it is only natural to want to show off extra learning. **Showing off is unattractive as well as distracting**. On the flip side, independent learners occasionally ask quick questions after class on material they have been studying on their own, without distracting anyone or showing off in the slightest. Sometimes the instructor can help by pointing them to the appropriate piece of the manual.
Rather than Piazza or Google Classroom, you are encouraged to participate in public forums like the great StackOverflow community, which is like the professionals' version of CS class forum. No one there will think you are showing off, not least because the pros there are *really* impressive. Here, for example, is a posting on StackOverflow by a great student. The question was answered by Seth Tisue, the lead developer of NetLogo! Also notice how polite most

people are on StackOverflow, including both the student in the original posting, Mr. Tisue in his generous response, and the student again in saying "thank you". **If only real life were like this.**
If people want to burnish their reputations within the class in a positive way, I recommend that they answer questions on Piazza or Google Classroom, without condescension or outside-the-syllabus material. You can help lots of people by writing high-quality, well-tested hints or answers to questions about the material.
People who enjoy learning about computer science will feel rewarded by taking more comp sci courses at Stuy or participating in the comp sci community outside classes. Both activities will earn you the company of independent learners who are nice people who share your interests. This is why you went to Stuy, whether you knew that in advance or not.

This manual was made possible by: Ms. Genkina, Mr. Holmes's class page, Mr. K's notes, Mr.DW's advice, Mr. Brooks's careful revision.