Introduction to Computer Architecture

Assignment 2

Question 25 Compilation

Of millions of advice you've been told, the one I prefer is enjoy being you.

I hope you really enjoyed the class (at least for some moments) so far. You decided to study Computer Architecture with me among several instructors. I truly appreciate your trust and your continuing support, understanding, tolerance, and cooperation. Ever since we met, I keep working on how to provide you with a satisfactory learning experience in return.

For almost all previous editions of this course, an assignment question sought to solicit thoughts and suggestions from the participants. For example, do you gradually understand strategies or things from different perspectives and weigh their tradeoffs? What do you think is the real challenge for you to learn this course? Do you consider interactions in class helpful? What held you back when you were trying to ask or answer questions in class? What suggestions (for better learning this course) would you like to provide to other students? What help or assistance would like from me or other students? All their thoughtful and constructive feedback has encouraged us toward a more rewarding computer architecture class.

This time, I would like you to introspect beyond this course. Taking a course should be rewarding in many possible ways. As we discussed in the first lecture session, even if you may barely practice computer architecture principles after the class ends, if whatever you learn through this class---whether it be computer architecture per se, a philosophy it implies, a study tip or inspirational quote we share, or a new friend you know---keeps driving you toward your greater self, this course fulfills its mission.

In particular, you are highly expected to develop a clear vision and be determined to strive for it. Most students in the computer architecture class are junior. The third year cannot be more decisive for your future. If you aim to work in an IT company after graduation, start practicing skills that help you ace the interview. If you plan to pursue a higher degree, join a research lab to cultivate research experience and application materials. If you have not decided, do both if your time and energy permit, see which one you really prefer. Try to make your decision based on your own goal and experience. Work with people who keep your interest and passion alive. It is really, really important to identify a right role model to emulate and learn from. It is also highly decisive to focus on what really is essential, especially given that some of constantly emerging paradigms might turn into hypes and fade away. Stick to golden rules that should be objective during the selection. It should not be simply about what one claims to be or what one claims others less so. "See the world not as it is, but as it

should be." Think of the proverb "shallow brooks babble loudest, still waters run deep" once in a while. (Or as sg put it: "shallow water hualahuala, deep water kckc.") In return, be part of the initiative that motivates yourself and people around you.

Meanwhile, if you ever consider assistance from me as possibly helpful, whether course related or beyond, never hesitate to reach out. As I proudly claim on my webpage, I am always proud to be part of the journey for someone to excel. And I am pretty sure that I would also love to be part of yours as well.

Therefore, with this question, I would like you to share your thoughts on your goal and plan. For example, what is your goal after graduation? What is your plan to achieve that goal and what challenges might be involved? How do you manage to be motivated and determined? What helpful advices or suggestions did you get from senior students and professors? What suggestions would you like to offer peers with similar goals? Or, it is possible that you are still finding your goals. Don't rush and take your time. Being at such a young age, you have infinite possibilities to live your dreams.

"Where are you? Here.
  What time is it? Now.
  What are you? This moment."

"Old urges continue to arise, but urges do not matter; only actions do."
"A warrior is as a warrior does."

"While they are deciding, make even more art."

So pleeeeease, live a life you deeply enjoy and will remember.

If not now, when?

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Thanks for sharing your thoughts and for all your suggestions and acknowledgements.

I would like to share with you this anonymous complication of all the collected feedback. It is a perfect way to understand more of our peers and resonate with them. "If you don't walk out, you will think that this is the whole world."

Responses may be provided aperiodically. So far, I have contacted two mxs for responses. The first one is for the first mx handing in Q25. Feel free to reach out if you'd like to discuss with me.

Of millions of advice you've been told, the one I prefer is enjoy being you.

Embrace life's big adventure and devote to enjoy the best things in life.

Wish you a joyful ride on every adventure you take!

Actually my goal is a combination of idealism and realism. I plan to be a programmer in a company before I am in my 40s. During this time earning enough money is a priority. Then I would like to work on something to my interest, say, becoming a musician, or opening a shop, etc.

The motivation is, I guess, exceedingly complex. Firstly, doing research hardly attracts me, because I think it is a process full of loneliness, pressure, and sometimes, frustration. I entered a laboratory last year and tried to work on Machine Learning, probably the hottest branch in computer science. Many students (and peers) devote themselves to it partly because publishing papers is relatively easy and relevant jobs are promising. But I just found the research experience quite tedious. It seems that the performance is dominating in this area and no one cares why a model performs well (in fact they cannot explain). To me, it is definitely not the kind of research that I imagined before. Other areas are also discouraging either because they take much more time for some achievements or their requirements seem very high. So I often feel at a loss when doing research.

Comparatively, programming is more suitable to me because the results are only based on the codes, and every result is explainable. I still remember I started to code when I was 9, and I fell in love with it mainly because I successfully printed a "Hello world" on my screen. I think this is what really gives me a sense of achievement. Nevertheless, becoming a computer engineer involves lots of hard work. In addition, apart from computer science, there are still many colourful things that I am enthusiastic about. So I just do not want to devote my whole life to a single job.

However, my parents and my seniors suggest me to pursue a higher degree, given that I am not in urgent need of money and getting a degree is rewarding not only for a career but also for my overall abilities. So I still plan to take exams or apply for some universities for further education when I graduate.

Of course, challenges do exist. Firstly, entering a good university is difficult, especially in recent years. Besides, the living expense is increasing at a high speed, so young people tend do suffer from huge pressure economically when they enter the society. I sometimes wonder how much money is enough for an ideal life and whether I could earn that much money.

The next question is how to get motivated and determined. Frankly speaking, I feel unpleasant every time I come across this question. After taking with many friends, I find most of us suffer from peer pressure, and I am no exception. There are too many excellent people in this college, and they work so hard even at a sacrifice of health. Some guys are even crazy at grades and they take good grades for granted. I once got indulged in deep depression and doubted myself. After a very long time, now I feel a little bit better. I try to forget about everyone else and focus on myself, and try to congratulate on every bit of progress. In this way, I find the answer to this question -- self encouragement is significant. I am still striving for a more optimistic attitude, and I hope one day I can become a person full of motivation.

Finally, about the suggestions. I hope we can focus on those chapters that are new to students in CA but not mentioned in CO (Computer Organization). Wish kg happy every day!

It's long long long time since I last wrote anything conclusive about myself. Or even worse, I might never had the ability to critically think about my 20-year-long life nor did I experienced enough to determine something firmly as my **goal**. In fact, I doubt it even now, but the least I can do for **me** is try to reach a seemingly persuasive conclusion (at least for me), that's gonna **drive** me for a period of time.

I consider myself as a **enjoy-my-life** type of person. I tend to fall in love with a wide variety of things after I dive into them deep enough.

That said above, I don't think I'm just that kind of **tip-the-toe** and be excited for three minutes kind of guy. Because I could only feel my liking for some of the aspects in my life after I learnt quite a lot about them. True it is that I don't hold on to most of them forever, but I'd blame that for too short a life to live rather than that I just love new things instead of the old, since when I pick them up a while later, I find myself enjoying most of them even more, regreting about not having the chance to do them more at the time. For example, after I took enought time to install and execute stuff on and deploy a significant amount of **Linux Server**, I found myself quite interested in it and I got a nice score in the corresponding summer course. However I'm also personally dramatically attracted by **Computer Graphics**, because I really think they're fascinating to look at and extremely rewarding to implement. Moreover, they're always quite chanlleging because of the involvement of hardcore math, which is another reason why CG problems attracts me. Then, after fully investigating the example code of Lab2 for this year's **Computer Architeture** I found myself extremely obsessed with it too. You can see that because I really took time to write my experiment report for Lab2 and Lab3. And I'm also a capable (for now) **Swift (iOS Development)** developer, after I created a fully functional APP with about 5k lines of code in Swift (it's a high level language so 5k isn't a small amount code). Then I find it interesting to play with a **STM32** and soldering all kinds of crazy module. Then I find training **Neural Networks** rewarding still...(I guess the only "thing" I love, the love for which hasn't been interrupted for a long time, is my girlfriend.)

This leads to some/a lot of headache.

First of all, I'm unable to determine firmly what it is that I want, because I **want them all**. It's quite annoying because I'm fully aware of the fact that *I have limited time and energy to explore this glowing/gliching world around me.* I even have other crazy dreams like flying a personal plane or driving fast cars on circuits. It's quite obvious that I don't want to be famous or have a huge impact on this world or anything. I wasn't born in that kind of family, raised in such conditions, and the thing in this little skull is not sharp enough for that. But I still want them all.

Secondly, I don't have enought time to really dive deeper into those things I like. The amount of effort it takes to make me interested in something is just above the line of being **passionate for three minutes**, but it's also just below the line of being able to **really master** something. This confuses me sometimes. Because it looks like, the world wants you to be a **single-minded** tool *for the society*, *to make money* and *to contribute more or discover things*. They love it when you have a lot of experience in one thing and one thing only. But come on, why can't we be able to enjoy ourselves?

Actually I think in this 2 and a quater years in this "beautiful" (sometimes) campus, I've found some answers to those headache:

It's actually OK to love a lot of things. It's totally fine to enjoy all of them if you have the "capital" for it (for example, if you're born rich, which, sadly, most of us aren't). But if you want to make a living and at the same time enjoy yourself, *maybe you should try to find one aspect that intrigues you the most and turn other things into tools/side knowledge that helps you along the way,* for the time being that you're forced to make a living. I'm current setting my main focus on keeping a good-looking GPA and **Compute Graphics**. A lot of thingss I love actually can pave the way to explore in this vast world. For example I'm gonna be fluent at deploying/managing a Linux Server for some command-line graphical computation. And I wouldn't be afraid to build my own hardware when it comes to that day. Lastly I'd also be able to bring the experience to a vast audience with my familiarity (maybe) with application development and UI Building. And... if we're to follow the trend, I'm also gonna be able to train basic neural networks happily.

And, as my mentor said:

> *It's quite important that you learn a lot of things during you undergraduate years*, for you're just starting to learn about this beautiful machine you're typing on. Don't make haste. Just take your time to explore, experiment and guide yourself along the way. Eventually, your instinct will guide you to your own holy grail. Otherwise, why would any university try to teach you basic courses covering vast areas of Computer Science in your undergraduate years? If you're never to use them in your life?

Ahh. I guess I don't even know what I just typed/said. It's a mess. Sorry for some misspellings and my pathetic Engish.

PS:

Also, it's not hard to notice that the distance people tend to keep with each other is in proportion to their age and experience (mostly). *It's just hard to find someone to share you with life experience/lessons that you may feel inspiring. hard.* **So I really really appreciate the amount of effort you put into trying to bring us closer (us: this whole class).** I guess this is quite brave/novel for a tutor in this area where everyone are just teaching and examing and life slips through years. Only one problem: As mentioned above, people tend to close themselves. *So maybe this kind of T25 is more relaxing for us to really expose ourselves and we ZJUer should have more of this.* It's fairly easy to notice that most of us just stay muted forever in **the group chat** right?, including me. My reason is that those people that talk a lot in the group chat has already formed **their own culture**, which might not merge easily with ours, so we seldomly try to express ourselves.

And as for this course... Yeah... *It overlaps with Computer Organization tooooo much... Just too much.* It's not that we've all mastered the knowledge. Actually we may have already forgotten about a lot of things. But it might be worthy of teaching pipelining in a greater depth, especially its actual implementation. I find this a common phenomenon for ZJU CS courses: too much theorizing and way less coding. For example, the sample code for Lab2 is actually quite sophisticated. We can tell that it's written by a well experience guy even if I don't know a da*m thing about how it actually runs. And when it's in action, when the moment everything magically works comes, it's just amazing. Maybe we should consider teaching the students about this more?

I think I'm gradually know how Pipeline works but still there are plenty of problems to be solved such as the speed or some solution for the hazards. I think communication in class is helpful , it helps me to understand what it is, and something it extends. I don't think I have learn enough , so I just keep moving.

About my goal or plan, I only have an ambiguous graph, I think I'm interested in CG/CV, it looks more charming to me, I want to go further in such field and finally work in the relative fields. To be honest, I don't have much interest in hardware part, maybe it's the reason that we can't have a comparation to realize how powerful the idea is, just solve one by one problem, I can't see whether is it good enough to compare the CPU in practical use. And even if we have such good a CPU , what can we do? I mean what is the transaction that we couldn't do before but which such a CPU we can handle the work. All of the factors lead me not much interest in hardware. I think in order to leap further, I need an instructor or guider to give some tips about how to go the path. The next year is the critical year of my school life and I want it be it ought to be . (Reading, improving, trying something new and fantastic, also working for the goal)

To be honest, I'm not that into computer science. Despite most of the teachers I met are nice and competent (especially KaiGe!), seldom do I find it interesting when taking lessons, doing experiments, etc. That maybe why I didn't do well in my courses. I'm now participating in an AI research lab, but I'm not so sure whether I enjoy it or not. I can't tell the difference of feelings between enjoying the results and the process.

In sleepless nights, I've been questioning myself why I chose ZJU, majoring in CS. What if I went to Renmin University and studied law? I'm quite confident that things will be different. I believe I am talented in law, not just because I got a full score in the Economic Law, but also because I find most laws I read natural to understand. I'm wondering if I should change my major and get a master in law.

If not, maybe after graduation, I'll become a normal software engineer. Then when I'm tired of struggling, I'll go back to my hometown and become a civil servant. Since this way I can earn a lot of money, I find it acceptable. However, if I change the major, the first challenge is to pass the postgraduate entrance examination, and I have to bridge the gap with those majoring in law during undergraduate. What's worse, I maybe not as gifted for law as I thought. Too many risks to take!

Well, you might never have these worries. I admire you to have a career you both enjoy and can devote into. Maybe I should go to Zhijiang campus and take a lesson, to see whether it will spark my interest or not.

Firstly, I want to state that nobody would be eagle to write this after finishing all the problems in about 4 hours. However, when I find this on the Internet, it becomes an incentive to me to share something about CURRENT me.

Introduction to Computer Architecture

Assignment 2 - Solution
Due April 15, 2014

$$\text{Speedup} = (1 \times 1.22 \times 1)/(1 \times 1.425 \times 0.6) = 1.17$$

Actually, I'm totally in dark of whether you're familiar with the formula listed above. So just treat it as an Easter egg.

When I am committed to this homework, it gives me an illusion that I am solving the puzzles in Computer Organization, and thus I feel the flight of time. Undoubtably, I do grow up in the recent 2 years, although I'm still in lack of adequate techniques and skills. So, when I am at the crossroads of my own way, I feel puzzled about where to go. What can I research on? Can I get some significant result in the next 1.5 years? If I can't, what's the meaning of my devotion to research? Why not be a front-end developer directly?

I just stubbornly hold an opinion that if we do something, we should make it of value. Maybe we get entertainment, self-grow up or some other REAL things. However, after I read the papers, I begin to doubt whether I can be outstanding enough to gain my own acknowledgement and whether I can gain something real when all the

efforts are in VAIN. In other words, 本物を手に入れるか？

I truly appreciate that I have taken this Computer Architecture class, I have learned a lot besides the knowledge of course.

I learned GO game when I was very young, and I was the captain of ZJU GO team last year. I decided to learn computer science because of AlphaGo. But I find that many students are crowded to do the research of AI models. What they do is to use the exited models and adjust the parameters. I think the work is just a application work instead of a creation work. I am interested in cyber security when I have taken some security class and participated in lectures held by school of cyber science and technology of zju. I started a srtp research last winter about contingent payments for AI models based on zero-knowledge proof. This research uses zero-knowledge proof to guarantee the security of transaction of AI models. I also participated in ATCF this year and learned a lot while solving the puzzles.

My plan is to pursue a higher degree in cyber security field. I haven't found the specific field in cyber security to learn, for I just taken the basic courses of cyber security. I plan to join a research lab after finishing the srtp research, maybe next semester. And I will participate the forums held by school of cyber science and technology of zju to learn about more of security and find my goal.

由于英语水平太差了，这个我还是用中文吧……
关于未来的各种情况我也考虑过了，虽然选专业的时候考虑了未来就业可能会比较方便，但是现在看来，我对这个专业的兴趣实在有限，天赋也有限（但是别的领域可能也没天赋）。目前看起来目标可能是考研，但是即使在本专业考研也绝对不会在研究方向下继续学习下去了，应该会加强自己的工程能力吧。可能还是希望能在计算机相关领域进入公司工作，但是研究领域必然不欢迎我。
从高年级那里得到的建议可能只有这个课很难，实验也很难，所以要做好心理准备。事实上我也觉得确实如此。尤其是英语不好，听课也挺不容易的（所以凯哥可以多说说中文吗，拜托了）。
所以现在非常迷茫，唯一确定的就是得开始复习考研数学和英语了。剩下的精力应该会用来提升一些实用的技能以便未来好找工作。人生好难。
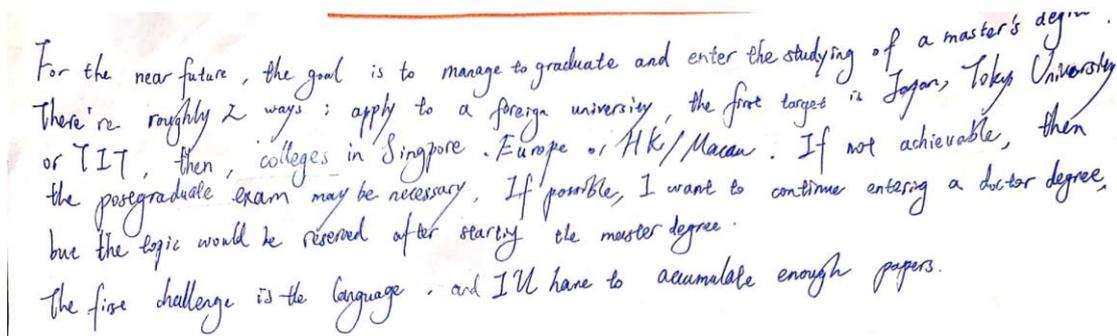
For the near future, the goal is to manage to graduate and enter the studying of a master's degree. There're roughly 2 ways: apply to a foreign university, the first target is Japan, Tokyo University or TIT, then, colleges in Singapore, Europe or HK/Macau. If not achievable, then the postgraduate exam may be necessary. If possible, I want to continue entering a doctor degree, but the logic would be reserved after starting the master degree.
The first challenge is the language, and I'll have to accumulate enough papers.
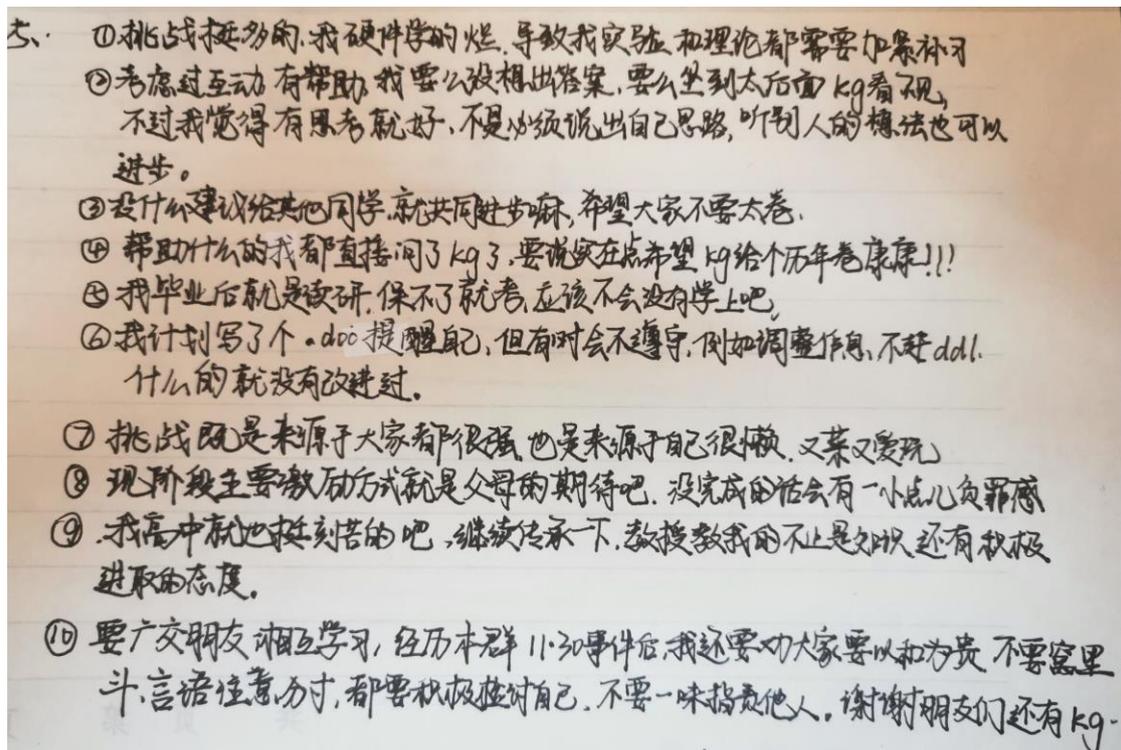
I was very happy in Kaige's class.

Teacher Kai is very young, very close to students, like seniors, and often in class to discuss problems with us, the classroom atmosphere is very relaxed and happy. In the class, we learned a lot of knowledge and ideas of computer architecture, and also had a deeper understanding of computer design. For me, the most difficult thing in this course is to figure out some structural details, such as how the address of the memory section is stored, and the logical relationship of the Stall of Pipeline. On these issues, the textbook helps me a lot. Because I am introverted, I don't often answer questions in class. But I like my classmates' answers to teachers' questions, because I can always learn new knowledge when listening to their answers.

I don't have many ideas about my future plan. Recently, I have been preparing for the exam of studying abroad with my classmates and practicing English, but I have no idea about my future plan. I think I need a role model and a partner to learn from, and I am actively communicating with my friends about these things. I hope to be an excellent person, because

I can help more people, just like the excellent students in the class, but I am not anxious about being ordinary, the learning process is very interesting, at other times, I also like to spend time on other hobbies.

Thank you very much for your words, which are very thoughtful and touching. I wish you happy and make progress every day

六、①挑战挺多的，我硬件学的烂，导致我实验、理论课都需要加紧补习
②考虑过互动 有帮助，我要么没想出答案，要么坐到太后面 kg看不见，不过我觉得有思考就好，不是必须说出自己思路，听别人的想法也可以进步。
③没什么建议给其他同学，就共同进步嘛，希望大家不要太卷。
④帮助什么的我都直接问了kg了，要说实在点希望kg给个历年卷康康！！！
⑤我毕业后就是读研，保不了就考，应该不会没有学上吧。
⑥我计划写了个.doc提醒自己，但有时会不遵守，例如调整作息，不赶ddl.什么的就没有改进过。
⑦挑战嘛是来源于大家都很强，也是来源于自己很懒，又菜又爱玩。
⑧现阶段主要激励方式就是父母的期待吧，没完成的话会有一小点儿负罪感
⑨求高中就挺刻苦的吧，继续传承一下，教授教我的不止是知识，还有积极进取的态度。
⑩要广交朋友 和互相学习，经历本君11.30事件后我还要劝大家要以和为贵 不要窝里斗，言语注意分寸，都要积极地对自己，不要一味指责他人，谢谢朋友们还有kg.

Hello, kg! It's so kind of you to provide us with such an opportunity to express something beyond the course. Actually, I was very surprised when I read your letter. In the university, few teachers are willing to communicate with us students about daily life, emotional issues, and future development. You are so energetic and considerate, just like our old friend. I fully trust you and I'm very happy to share my thoughts with you.

Firstly, regarding the Computer Architecture course, I have to say that your teaching in Chinese will be clearer and more interesting than in English. Your English teaching is also very good, although sometimes I didn't fully understand certain knowledge points and then I would start to get distracted QAQ. Since a lot of knowledge in Computer Architecture has been learned in Computer Composition, it would be appreciated if you would provide us with some exercises to consolidate the knowledge. Personally, one of my troubles is that since junior high school, no matter what class I attend, I often get sleepy in class… Even if I had enough sleep the day before, I might have difficulty in staying awake in class… So if you find me fallen asleep in your class, I'm soooooo sorry and pleeeeeeeeease remind me.

I would like to talk more about my confusion about future choices. In fact, I never thought that one day I would take computer science and technology as my major until I switched my major from physics to Computer Science last year. I have only learned the basic C language before I switched my major, so I was unconfident in my own coding ability. I can get relatively high scores in many courses, but I always feel anxious about my poor coding ability that I feel a little bit reluctant to write code. But as a programmer, coding ability is productivity. So I have to practice more on Leetcode or other websites, to be honest, it's quite painful…

Like all my classmates, I strive for a higher GPA, but when I recall many courses now, I find that maybe I have just mastered some skills for examination and did not really acquire the skills that are helpful for my future work. That is awful and makes me very anxious. Can I apply the knowledge I have learned in my future work? Is it necessary to find an internship if I choose to study further for master's degree? How should I prepare for applying for an internship? Am I qualified to apply for an internship?

I am currently doing graph neural network research under Professor Yang Yang's guidance, trying to make it clear whether I am suitable for scientific research. I consider myself not smart enough and sometimes feel inferior due to it. God bless me to figure out where my interest located in. By the way, if you have any great ideas about graph isomorphism, it would be highly appreciated if you can give my teammates and me some advice.

Wow vote for kg!

Sincere thanks for your help and guidance! May you find the unique beauty and the source of happiness in your life!

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　　上凯哥的体系结构课程已有两个多月了，很喜欢凯哥上课的互动问答，利用同学的交流给出 **PPT** 上的不懂的点的解释；而且除课程知识以外，凯哥讲的一些话也确实有影响到我，我喜欢这种努力学习，幸福生活的人生态度；在课程任务量安排上，对我而言我是觉得是合适的。因为之前一直只是听课看书，基本没有怎么做过习题，所以经过这次作业，我感觉让我更好的复习了一下之前几次课的知识。至于我之后的打算，我打算考研，大二是我大学感觉最晕头转向的一年，由于种种原因，感觉大二的情绪波动很大，成绩也下滑了，大二学年成绩落到计科排名 **50%**左右。感觉保研无望，进入大三后，我开始自己做减法，心里不要想得太多，放平心态，着眼当下，享受每一天的学习生活。

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For me, I tend to go on pursuing a higher degree after graduation, better if I could get a chance to study abroad. I reckon that I can gain not only more knowledge in this process, but also more skills, friends and richer experience. Plus, getting a master degree (or even Ph.D) may contribute to my job-searching or business-starting in the future.

To achieve this goal, I have to cultivate my research experiences and skills in some research labs as well as practicing English and get the certifications. I've been doing some research lately and preparing for the TOFEL test for some time. Hopefully I can manage to get a good score in the test.

However, there's another thing that's bothering me -- my GPA. It's quite below my expectation and I don't have a good ranking among the students, either. (I'm so vegetable) I know that it could have been my inadequate capability to study all these courses and compete with all those competitive students, my failure to manage time, or even my laziness that resulted in such a consequence, but what passed cannot be changed. I felt anxious and frustrated that this may make it very difficult for me to achieve my goal, and that's when I decided to take every effort starting from this 3rd year of my college life. Taking the course of *Computer Architecture*, I've realized how kg and some classmates devoted themselves into giving wow lectures and learning new knowledge and skills. They're all role models from whom I can learn a lot.

I'm quite confused by now (and kind of unconfident), about what I'm actually pursuing, about what I can do and what I'll be doing in the future. It seems like I haven't found the thing that really interests me (in terms of academic). Nonetheless, I'll keep looking for it actively and do my best to get a higher grade. Afterall, progress and success doesn't come from nowhere.
Finally, thanks a lot about kg's delivering your well-prepared lectures and being so easy-going with your students, as well as offering this opportunity asking us to introspect on ourselves. Thanks for reading.

Since I make hardware & security my future field, I think computer architecture is quite an important class for that field. But it's awkward to say that most of CA's points are coverd by other classes, we have learnt memory slightly in LCDF, CPU and cache and VM in Org, and OS also covers a large part of cache and VM, so the actually brand new thing to learn in CA is pipeline. Fortunately it's not so simple to make this class boring. But still I think we can focus on deeper things inside it. (for example, dynamic scheduling is a very interesting topic I think) As for the other parts in CA (cache, VM, etc.), I think most of the students are quite familiar with them (things like write back/through/allocate/around, diretc-map/full-asso/set-asso, miss-penalty are all important key points of organization), so time can be saved for other things I think.

As for the class itself, I think you are a very energetic and friendly teacher, and your English tongue sounds very comfortable, so just keep on using pure English in class, we can practise our listening ability as well as improve the knowledge of terms in English.

Finally, thanks for your suggestions on our future plan. As for my own plan, I think I am really not interested to work in an IT company just after undergraduate. So maybe continuing my study is a better tempory solution. I choose hardware just because I think I can do well in hardware though that's not what I am really interested in, I am not interested in those hot topic like ML or CAD as well, I still cannot find what is my actual interest point. The only reason I can lead a quiet life like this without much worry is not to think to much.

#25.

To start with, I'd like to share my goals and plans to answer this problem #25. My goal is to become a programming language researcher. Thanks to Yaozhu, one of my most appreciated seniors, I discovered the solid theoretical foundation of software and programming languages. Developers enjoy wonderful programming experiences, and I would love to make programming wonderful, using theoretically and pratically combined methods.

Therefore, to fulfill my goal, I have to make plans. General steps are quite common: to approach relative faculties, to do research projects, and to apply from graduate school. However, it's a hard and long journey. Since there's no faculty of programming langauges in our college, even in most schools in China, I have to reach out to overseas researchers. And to be honest, at first, due to my lack of confidence and related research experiences, due to the lack of former experiences from other fellow students, I thought to give in and to seek 'handy' opportunities. Thanks to kg'd advice, I didn't give in to myself without any attempt. How? I keep this idea in mind. I'm making attempts that few people have done before, and all the efforts I have made will pay off one day, just like sowed seeds will grow some day. Once thinking of this, I feel excited and somewhat, bloated, xixi.

山再高，往上攀，总能登顶；路再长，走下去，定能到达。With the accompany of parents, with the encouragement from kg and friends, with the confidence in myself, though there's no guarantee to success, at least I can live a life I will remember.

这题可以用中文吗？英语水平实在有限呀

从各个方面都能感受到凯哥的用心，这是我作为学生莫大的荣幸。凯哥的榜样多多少少促进了懒惰的我再努力一些，再用功一些。

凯哥说得很对，针对未来可能的不同目标，现阶段需要做不同的准备，当然也可以根据现在已有的以及之后一段时间争取到的经验，来定目标。但是很不幸，这两方面对我来说似乎都有些困难。从大二开始，这个问题就一直是逃不过的魔咒。我几乎 99.999999%不想继续本科的专业，因此我希望研究生阶段可以学习其他专业，这样以后找工作至少有一些余地。这样一来，基础落后的我需要尽早开始为考研做准备。第二个方面，我的父母认为完全换一个方向考研很吃力，所以希望我仍然考计算机的研究生，只不过可以选择一个相对轻松的研究方向，虽然对于我来说，这同样很吃力。学不会，吃力，吃力，学不会。即便我很幸运的考上了计算机的研究生，又十分十分幸运的从研究生毕业。（虽然幸运一词不太恰当，毕竟是靠努力的，幸运的意思大概在概率上符合）那不就意味着我在这个领域工作的概率更大了，去其他专业相关的工作的路更窄了。有时候会想，我有多少资本能用快乐这一标准来决定我做什么。也许父母的建议能够让我的人生少走一些弯路，但是这个转折也只是可能会到来。逃避让自己不快乐的事，在这种情况下，可以被允许吗？想不明白。

理想状态下，我希望有多余的精力去学研究生想考的专业的课，然后准备考研。但是现实状态却是我的能力和精力不足以完成本专业课程规规矩矩的任务。这又进一步催促我赶快决定，是水到毕业（还要怕水不过去），其余时间用来准备跨考，还是一门心思挣扎到毕业。

To kg：

　　不知不觉半个学期过去了，很高兴认识kg，还记得当初的第一印象是，推开体系实验室的门，那个笑得阳光灿烂的小男孩，后来的体系课上，kg很认真地在记每一位同学的名字，努力地和大家交流互动，那种没有师生距离感的课堂令人很舒服。虽然有时候跟不上上课的英语语速（自己英语水平太渣了呜呜）

　　说起来这半个学期我经历了许多，前段时间准备robocup中国赛，每天凌晨三四点从机器人实验室回寝，晚上一下课又跑去debug，落下了许多课程，但所幸在南京的比赛中，击败上海交大，拿到了中国赛的冠军（也许保研有加分？）以至于上个周末才自学完了体系实验，并赶在ddl前验收成功了（长嘘一口气）前两天实验室的学长又跟我们谈论保研／就业的问题，才突然发现这件事好像已经离我们挺近了。说实话，我内心并没有想好自己该走哪条路，科研发paper的生活似乎不是我想要的，但我又不确定本科就业，我是否有这样的能力？其实我挺享受代码跑起来能真正被人所用的感觉，而这样的感觉似乎与科研的方向又不太一致。说了这么多，其实我还是没做好决定，如果kg有什么建议，不妨来给我指点、指点迷津！

　　相信命运让我们在体系课堂上相遇，那它也能帮我们安排好未来的路。加油吧，kg！加油吧，自己！

Dear kg,

I feel so lucky to meet a phenomenal teacher like you. I have seldom met a professor who is as sincere, diligent and amiable as you. I would like to say that your words give me a lot of warmth and inspiration and I truly enjoyed the class. Special thanks to you for accompanying us in the course of Computer Architecture.

In my opinion, the class carries more than knowledge. In today's age of Internet, whether it is reading textbooks or papers, or taking online classes, we can easily obtain knowledge. I really appreciate your view on this course's mission. Every time I see you active in QQ group, or update course slides late at night, I was moved. You are a person who really cares about his students and is hard-working and industrious, and I seem to find a hundred motivations to learn from you.

As a major compulsory course, let me go back to the course itself. To be honest, I'm not as proficient in Computer Architecture as so many excellent students in my class. However, I gradually understand some strategies from different perspectives and weigh their tradeoffs. You have said that entering junior year, a lot of courses focus on the tradeoff, which seems to be a string of previous basic lessons and a more abstract and high-level thinking to understand computer systems. There are many professors teaching this course and you seem to be the only one who teaches in English. Frankly speaking, due to my English limitation, I cannot quite keep up with you in class. Sometimes a concept that is not understood can make it difficult to focus on the subsequent courses. I suppose for me, it's going to take a while to fully adapt to teaching in pure English, but this course is really a good start. Maybe the next time you talk about key knowledge, you can slow down or change your tone a little bit, which is beneficial for our better understanding.

Interactions in class do help a lot to understand some knowledge in time and can deepen our impression. Last summer, I took a summer online course at UCI. I feel that the biggest difference between traditional Chinese and Western classrooms is the interaction in class. Interaction urges us to think rather than listen to the teacher's explanation blindly. However, I am not brave enough to ask

or answer questions in class. I prefer to communicate with my classmates and teachers after class or think about the answers myself. I will feel embarrassed if my answer is wrong, especially in front of so many proficient classmates. As for suggestions to other students, though I do not excel at Computer Architecture, reading the textbook carefully and following up the professor in class are helpful.

With regard to my goal after graduation, I plan to pursue a higher degree in Zhejiang University. I really hope I can gain postgraduate recommendation and find a wonderful mentor. However, I feel like a non-traditional engineering student and I'm not sure if I'm going to do computer development jobs or anything like that in the future. When I just entered my sophomore year, I even had the idea of changing majors. Since I didn't have a computer-related foundation before college, I was lacking in programming skills and experience, and I haven't found a research direction that I particularly like and fit. But as I studied further, I gradually developed an interest in computer science and decided to pursue a higher degree.

So far, I have not been trained in scientific research in the computer field. But in order to achieve my goal, I plan to study specialized courses well in this semester to lay a solid theoretical foundation for my future scientific research. And I will try to contact my tutor and join a research laboratory during next semester to cultivate my scientific research experience. I really like the proverb "shallow brooks babble loudest, still waters run deep". Although I may be relatively weak on the basis, I will continue to work hard to find areas that suit me and interest me as early as possible.

In the end, I believe your contributions and efforts to this course will give you back. Apart from high grades, I believe it is your sincerity, concern and proficient professional ability that make everyone rush to choose your course. I truly enjoy every Monday morning and I believe this will stay in my memory. Words are powerless to express my gratitude.

Best wishes!

我在大学三年遇到过很多的老师，最大的感叹是即使在浙大这样的学校中，老师们的水平也是参差不齐。我相信绝大部分的老师都具备足够的学术水平和专业修养，但是在我看来，真的是极少数老师具备「传道授业解惑」的能力。在我感受到这一点后，绝大部分的课我都主要依靠自学。有了老师的PPT，绝大部分的课程我都能在课下自己完成。

我同样也在思考，如果成为一位老师，我应该怎么教给学生知识。我想我首先需要是一个谦逊的人，对自己对这门课程都必须有足够的尊重。我愿意把学生经常问到的问题收集起来，作为未来的重点，讲一些学生很难自学习得的东西。其次，我希望我是一个真诚的人。「知之为知之，不知为不知。」我希望我面对学生，有敢于说出「我不会」的勇气。也希望学生在我面前，有敢于暴露自己问题的勇气。最后我希望我是一个有同理心的人。作为一个学生一路走来，我很清楚大家心里在想些什么。所以我想，我会避免让学生尴尬，能够找到合适的方式，让同学与我单独面对面。

凯哥您，在我看来，是个敏感的人，应该也在意别人的评价。当然同时也是一个谦逊的人，一个真诚的人，一个有同理心的人。在您的课堂上，我很羡慕fad、tzh那样能够积极和您互动。我不知道当他们能在课堂上自由提出自己意见的时候，内心的想法，但从我的角度，我很害怕在众人之前展示自己的无知。即使有个地方想不明白，我也宁愿自己一个人在课下思考，或是与朋友讨论。我到了大学才明白，高中时候别的同学是怎么看待我们这些「活跃分子」的。

In the long run, I hope to become a person who knows not only technology but also humanities. I hope to become an entrepreneur, live a passionate life, and use my abilities to bring big or small changes to the world. In the short term, I want to go abroad to get a higher degree so that I can learn about the cutting-edge knowledge of computer science and meet more interesting people.

But there are also several problems bothering me
The first one is about how to choose and join a laboratory in the next semester of junior year. To be honest, I don't know much about the specific research directions of each laboratory just through the course of study. At the same time, I'm not sure if the professor will be willing to accept a student who will probably not be a graduate student in his laboratory in the future. What should I do?
Second, how to apply for overseas summer research and how to write application documents in the future also bothers me. I don't know if our college has an QQ group about studying abroad.

Sincerely, I am very moved by the last question.

Things I learnt: I do get to understand the strategies about computer organization/architecture that I didn't quite get last semester. So thanks for your hardwork! BTW, through this assignment, I also learnt how to type LaTex Math in markdown files. I hope that when you see my work, you would be satisfied with the neat equations and say, "nice job!"

Real challenge for me to learn this course: Maybe you're too shy to speak out loud in class? I feel that every time you ask someone a question, your voice is so low that makes you a little bit "afraid"? This in turn gives students a sense of uncertainty. Hope you could be more confident in class.

My goal and plan: I once wanted to get a postgraduate recommendation（保研）in the last two years of college. But considering the China-US relationship, many students decide not to study abroad, and my overall ranking is only about 40%, my future becomes uncertain. And worst still, I planned to take ILETS test in February this year. I prepared very well, even attended a simulation test and got 7.5. But due to the pandemic, I haven't take any real language test yet and **THAT** causes me to lose the chance for the 3+2 program ZJU with UIUC. I feel like the whole thing becomes a vicious cycle...

I have signed for another ILETS test next February (hope it goes well) and after that I plan to join a research lab about recommendation algorithm, stuff like that. I don't know after missing the 3+2 program with UIUC whether I could be admitted by a university the same level as UIUC **on my own**?

That's all for the thoughts.

Thank you for your reading.

　　关于课程，本人真诚甚至迫切地想要学好体系结构这门课。目前三年级阶段，体系结构、操作系统等硬件课程在知识上有着较大的相通之处，越来越深切地感觉到学得扎实则相辅相成。关于课程作业，目前的作业有实验、展示、练习题。关于实验，感觉体系结构的实验比计算机组成的实验要清晰一些。或许是因为有了计算机组成的实验基础，对于代码框架、实现机制等已经有了一些概念；理论课进度与实验进度符合，在实验之前对理论有了较好的掌握；对实验帮助最大的是已有的代码框架和其他同学的分享，尤其是其他同学的分享，让我对实验的具体任务和实验目的、验证方法等有了更清晰的认知，这是之前做计算机组成实验时所梦寐以求的，节省了大量时间少走了很多弯路。关于展示，本来以为会非常困难，后来能够有条不紊地完成，多亏了组长张潇予的优秀领导，小组中，论文阅读、交流讨论以及最后整合等都非常顺利，不仅在论文阅读和交流中学到了知识，还学到了展示方法等等（组长是真的很优秀呀，各项能力都很强，超棒！）。关于练习题作业，班里的大多数声音是"少食多餐"，我觉得不管是"少食多餐"还是像这样几章一起布置作业都挺好的，"少食多餐"可以缓解 ddl 临近期的作业压力，而这样多个知识模块一起布置作业也可以对近期所学做一个回顾。做本次作业之前以为自己都忘光了什么都不会，后来真正做题的时候，通过 ppt 其实能回想起课上听讲的部分内容，再加上看教材，总的来说并不困难。关于课上的互动，感觉大多数人都是边看教材边听课，对课上的互动不太感冒，但也想听听别人的回答，感觉目前的互动还是挺合适的。

关于自己，日后大概率考研。考虑略自闭的性格，还是考试更适合自己。还有一件必须提上日程的事情是托福雅思，很多对外交流项目都有分数要求。之前鬼使神差学过两期雅思强化班，准备明年开学初回来的时候考一次，可最近一些一起上课的同学出分都不尽人意，还是挺害怕的，寒假里要花大工夫准备。刚刚刷知乎的时候看到一位考了 5 次的同学分享心路历程都要看哭了。另外，关于要为实习和就业的面试做准备，暑假里尝试通过 leetcode 较基础的题目巩固知识为面试做准备，但开学之后没有坚持下来，寒假里要继续。

25. The question 25 is the hardest question for me in this problem set since there is no textbook I can refer to, no such encyclopedia I can google and an absolutely correct solution is obviously untouchable.

Seriously speaking, I'm not that sure what I should do and where I should go after I have got a bachelor degree in ZJU. I'm still hanging and seeing, but the definite thing is that I'll pursue a higher degree.

I'm so torn between going abroad and going to Peking to get a higher degree. Living several years abroad can be a wonderful period of experience and a top foreign university degree can be a strong endorsement for me to get a position in a university. However, a girl that we've been known each other for a really long time is studying in Peking, and there is a tremendous chance for a indestructible relationship if we can share our best years in the coming days.

But as you know, life is so changeful and complicated that we never know what will happen and who we can believe in. Pledge sounds perfect but I never believe in human nature. I'm hesitating, lingering and confused. I am always regretful for whatever I choose.

The only same thing between these choices is that, to fulfill my dream and stay competitive, I must work hard both on the courses and the scientific research project in this vital year. Also, I have to spare my time enhancing my poor English for any reason. It is also possible that I'll choose a easier way of life when I'm so tired of the so-called involution in this fucking society.

That's all I want to tell you about my goal and thank you for giving me such a chance as I never share with others what I'm truly thinking about.

Wish you all the best, Mr. Bu.

很高兴能以这种方式写一篇小作文和 kg 有更多的交流，ddl 比较重，希望不要因为我写的中文而不把我整合到 kaibu/comparch2020/Q25.pdf 里。在班上算是存在感并不太强的同学:)，发言不多，会认真听课做实验，但是效率不一定高。

对我而言，说体系的难点不如说是我硬件知识体系的难点，我对硬件知识的掌握应该存在很多不扎实的地方，有我理解能力的问题，可能也包含一些本科教学任务比较繁重内容比较杂乱的原因，但这不妨碍我跟 kg 研究学习体系课。在我看来，课堂的互动一定是有用的，不仅唤醒犯困的早八人，也有思考巩固的效果，只是我英文水平还太浅薄，没能达到和 kg 一样流畅表达几个小时的程度，很多时候 kg 的语速略微快于我接收英文的速度，所以不太容易跟上课堂提问，没理解问题的情况下也不容易在短时间内组织语言给出回答（我本人真的并不害怕答错问题）。如果要说能提出什么建议给同学或是之后的有幸选上 kg 体系课的学弟学妹，我真心觉得预习是大大提高听课效率的最佳选择，毕竟 kg 语速也有很多学长学姐提过，但是据他说慢慢又会回到原来的语速，所以自己上课前做足准备才是最好的，当然我也不太相信相似强度的培养方案下会有很多人拿出时间来预习任何一门课程。Kg 的体系无论是实验还是作业的压力真不算大，建议尽力理解体系实验的代码，可以跟着在 kg 验收的时候跟着听几个问题看看自己是不是能够流畅地回答上来，用以检测自己掌握程度。kg 几乎是我在 zju 遇到的最平易近人的老师了，看得出来他会为你的一点提高做所有努力，能与 kg 和课友们一起努力学习体系就已经非常幸运了，没有什么特别的要求。

如果说对未来的考虑，我希望毕业之后可以考研或者出国，当然如果选择考研我不会花费太多的时间用来上岸，出国当然是更好的，如果经济条件允许的话。说来惭愧，自认为大学也算努力学习了两年，到最后 GPA 并不尽如人意，也很难收获保研的名额。GPA 不高其实也有很多因素，但我不想推卸责任，其中当然一定有一些原因在于自己，那也就认了。大三大四的两年我还会一如既往保持孜孜不倦的学习态度，但是学习方法或许需要做一些调整，因为我是冲着读研的目标而维持着努力的心境与动力，我认为本科阶段的学习很难让我在步入社会之后有什么过人之处，我非常非常希望学习生涯中能拥有一个帮助我真正学会解决问题的研究生阶段，不是说非读不可，是我发自内心地希望能通过这样的形式证明自己，或许时刻提醒我自勉的并不是学以致用的诉求而是自证能力。

然而考研和出国都存在难度与不确定性，考研要承受上岸率的压力，出国需要很早做出准备，当然我指的是成为水平不低于 zju 的学府中的研究生，这应该是 zju 绝大多数学子的考量吧。而国内本专业考研想要进入水平略高一点的学校很难，难度最合适的只有本校考研，但是这里的"合适"也仍然是一个残忍的低上岸率，出国的话选择与自己 GPA 相差不远的学校，密歇根、UIUC 等等都是我比较合适的选择。说到计划，其实我的计划并不明确，当前也就是提早一年多准备好英语能力和 GRE，前提是学业方面没有落下。因为我还很难根据我的兴趣、未来收益等等明确地说服自己究竟选择那条路去走，所以也只能这样且行且想。跟我一样情况的学弟学妹能尽早决定走哪条路最好，当然或许很难，但是提早关注国外的优秀大学的要求与成本想必不会有任何坏处。加油，上学人！

1. What do you think is the real challenge for you to learn this course?

- 知识点比较多，虽然前面这段时间一直都在讲pipeline相关的，但是看了后面的一些，其实有些与上学期计组所讲的差不多，但是有更多的深入和新的知识点。还是需要靠自己及时看书归纳总结整理。
- 实验部分lab2虽然是"填空"，但是需要对整个pipeline比较熟悉，要真的看懂整个架构以及之后在这个基础上加入新的东西，其实对我是比较大的考验。要对每个指令每个阶段可能产生的冲突等比较清晰。

2. Do you consider interactions in class helpful?

- 我认为是有的，起码走神的时候会被拉回来（bushi），可以在讲到一些比较重要的知识点的时候起到提醒大家认真听课的作用。
- 而且感觉同学的回答有时候会更容易听进去（也许是有了不一样的音色？）不过还是希望kg在同学回答之后如果可以的话，稍微总结一下同学的发言，这样记忆会更深刻一点，我们也能get更加准确的答案啦！
- 互动也可以让大家彼此之间更加认识吧！开学的自我介绍还是帮助我匹配了很多的名字和人脸的！其实我感觉大学课堂这样的互动能让我感觉和高中不一样，有种：啊，这才是大学的感觉。

3. What held you back when you were trying to ask or answer questions in class?

- 首先我就个人情况而言，因为课前缺少预习，所以其实上课的知识点很多都是新的，是处于一个被动接受知识的状态，所以疑问会比较少，而且课堂大部分时间都在用于记忆和消化新的知识。
- 其次是有疑问的话我个人会比较倾向于先看书和百度Google，如果再有会和同学讨论，还不能解决的话会选择提问助教和老师。所以其实在课堂上提问emmm感觉我可能没有这样的勇气
- 而且课堂上活跃的同学感觉都十分的dl，有时候很怕问出的问腿比较傻

4. What suggestions (for better learning this course) would you like to provide to other students?

- 课前预习！我感觉预习之后应该会存疑，而且对听课更加有帮助。
- 自己及时总结，比如上节课的公式，感觉依靠课上例题其实还是不够的，还得自己课后多做例题以及好好理解每个公式中各个变量的意义，有助于公式记忆。
- pipeline的话还算是比较系统，及时回顾每个知识点，我感觉看书还是比较好的选择

5. What help or assistance would like from me or other students?

- 希望自己能多和身边朋友交流体系，我觉得答疑是不错的选择，然后如果可以的话kg其实可以让课后提问的同学整理一下这个问题？感觉很多时候大家的问题是重合的，但是会存在比较害羞的情况，而且可能同一个问题需要多次回答，如果能汇总之后像ppt的形式在课堂上或者群里展现一下，可能能够节省一些时间。之前的计组课程，老师在最后布置了一个作业，是让大家提交这学期关于计组的一些问题，最后的课程上老师进行了回答，还是解决了我的挺多疑惑的。因为有时候本来有问题，过了一段时间就忘记了，之后在考试里遇到了==

关于未来的目标，其实感觉选择这个专业，我对这个专业学习的热情有在递减？起先大一的C程和大二的汇编，就让我很喜欢，很想学好和真的获得这些知识，但是后来发现其实很多时候考试和绩点可能是更加现实的东西。之前一直在考虑要不要继续读研，现在还是觉得先得继续好好学习，既然现在正在学习的年纪和应该学习的时候，就应该把自己的学习工作做好。首先是自己努力学习吧，如果不能保研应该会选择考研这条路。现在暂时是没有考虑出国这条路的，之前有做一些自己的可能不全面的观察，感觉出国可能还是不适合自己。冬学期开始了，感觉不能像秋学期一样走一点看一点，按部就班的就完成作业了，这学期的

课程大部分都很关键，还是得好好学习！认真对待每个作业和实验，争取真的能有收获，能够开心的学习知识！

另外，很开心能在大学遇到kg这样的老师，也希望老师能更自信一些！我感觉在课堂上老师还是应该更加"霸道"一点！其实很多时候kg可以不用太过于在意我们的看法，如果这个知识点你觉得很重要，就算是之前讲过或者比较简单，其实还是可以讲的！我和我朋友这样的小白一致认为很多时候还是再讲一遍会更好！而且kg的ppt做的也很走心，针的很不戳！

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Dear kg:

I am writing to thank you for your excellent course "computer architecture", and after half a semester I consider it one of my favorite courses in ZJU. Your unique teaching style makes this class a pleasure to attend and study for. What makes me feel really happy is that the deadlines of reports and assignments are not so tight, It can be done slowly and I don't need to stay up late to meet the deadline. What's more, you are a very nice and considerate teacher, who is able to communicate with students on an equal footing.

But I have to admit that I can't understand what you are talking about most of the time in the class (even for those words being said in Chinese (﹃ □ ﹄)). As a result, I get sleepy from time to time ((~ ﹁ ~)~zZ). Sometimes, asking other students to answer your questions actually helps me better understand what has been talking about, and help me check myself whether I understand this part of knowledge or not. I think the reason why I can't understand your words is that you speak too fast and I don't have enough time to understand the detail (Actually, the main reason is that my listening ability is toooooo bad). It would be best if you could speak slowly and add a little emphasis on the important points in your words.

However, due to this situation, now I have to spend more time reading text book, which I hardly did in other courses. These give me a deeper understanding of the course contend. And the first assignment is really helpful, it allows me to practice preparing for a full English presentation, which is very enlightening and show me what it feels like to show understanding of some new research results in English (nervous to death, wow).

Talking about career planning, now I have already made up my mind to pursue a higher degree. And after several discussions with my friends, I have decided to continue my plan to apply for a master's degree in the United States, and at present my focus is the TOEFL and GRE test. I also hope to accumulate some experience in researching. Hence, I want to express my deepest gratitude for your kindness when I approach you and ask if I could try to do some research under your guidance.

Any way, to put every thing in a nutshell, I want to express my appreciation again, not only for giving us this amazing course, but also for your kind help and patience.

Dear kg,

Firstly, I'd like to tell you that I really enjoyed your class (for many moments). I've been feeling sick of my major for a long time, but this semester, Computer Architecture brought me a lot of fun (and knowledge of course). Indeed, I'm surprised that I can meet an interesting and kind teacher like you.
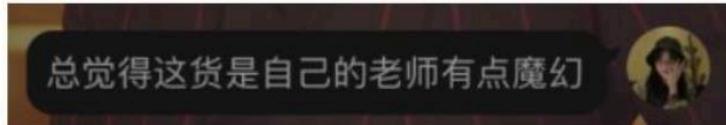
The interactions during class are really helpful. Such interactions solve course and exercise problems in time, while in other classes they might be delayed until the final's coming. When it comes to things that hold us back from asking or answering questions in class, it may simply because tls is so proficient that he can manage it.

I don't excel in Computer Architecture, so I really have few efficient suggestions for better learning this course. All I can say is to read the textbook carefully, and not afraid of asking questions.

With regard to my goal after graduation, I plan to go abroad for

further study. I don't have much experience, but I think persistence is a basic virtue for all the people having goals. In addition, I want to say that, there's nothing wrong for you to quit a career as a CS student, as long as the decision is made after careful consideration. I know many peers who dislike this major but don't quit just because its 'high position' and appealing salary. I hope all of us can find what we like, instead of what we should.

> As we discussed in the first lecture session, even if you may barely practice computer architecture principles after the class ends, if whatever you learn through this class---whether it be computer architecture per se, a philosophy it implies, a study tip or inspirational quote we share, or a new friend you know---keeps driving you toward your greater self, this course fulfills its mission.

Also, I want to say that I really love the sentence above, for both its grammar (hahaha) and meaning. To tell the truth, I can hardly remember any knowledge about previous classes (sad), but the feelings always exist and sometimes last forever. I'm trying to enjoy not the result but the process in each class and, can't say I manage it, but at least enjoy my time every Monday morning.

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  从小对未来的期待是能够导演电影，将自己所想所思表达出来，能够创作自己的作品是一件有趣又享受的事。但我没有去选择相关对口的专业，因为艺术类的专业对家庭经济实力、人脉等方面都有很大要求，且机遇也更加重要，而我在以上条件都较难满足的情况下，还需要承担家庭的责任和期待，每个人在成年后都或多或少地背负着一些压力，可能是怕自己成长的速度赶不上父母老去的速度，可能是怕生活的轨迹偏离理想太多。许多因素影响我无法去选择一条不确定性较大的路，故高三的我打算充分利用自己的成绩优势和逻辑能力，选择学习自己也很感兴趣的一门硬知识与技能，它不仅能保持我的学习和未来职业生涯不算枯燥，也能在我追求理想的过程中为我的生活提供保障和不被淘汰的能力。曾经想过与同伴一起创业，或者从商，但从现在的角度看来还有些许遥远。现阶段的我应该是更好地努力掌握能触及到的知识，在毕业后能在偏社会性的职业上有稳固和长远的发展，运用好专业知识的同时，发挥自己与人交往能力的优势。在有所余力以后，能够发展自己理想的道路，一步步塑造自己的生活。

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毕业准备直接去工作了，因为前两年比较水也没注意绩点，数学和物理又学得不是很好，所以现在专业排名 60%-70%，就差不多不考虑读研了。目前的打算是联系一下导师提前搞毕设，下学期把毕业要的学分补齐，大四就可以出去实习了。寒假开始刷一下 leetcode，学一下 java。有个在北京 Amazon 的学长所以有内推名额，大四能腾出空就可以过去试试看了

Thanks Mr.Bu for the sincere passage and the concern for our future. It's a great honor to be one of your students. As for my thoughts on my future, basically there are 2 alternatives, to be an engineer or to be a researcher. I have been long for the former for a long time since I believe to create something is the source of motivation for me to be a CS student. But recently I'm gaining interest in the later when I saw awesome works of researchers in different fields. Hence, I determined to be a master student to explore the deeper world of CS. For this goal, I've decided to be professional through the course and get prepared to be a researcher by following a research topic and reading some papers.

kg请原谅我用中文回答，自我认为英语水平确实不够来表达我想表达的qwq。

说实话经过数逻和计组以后，对于硬件课就没有很感兴趣，尤其是对于实验部分，虽然最后也能理解并做完，但其中的过程并没有让我觉得想写其他代码一样觉得有耐心，写着写着就不想写了，最后断断续续完成。

而在体系课上，我感觉非常棒的一点是kg会经常讲着讲着和同学们互动，这个互动比起提问看起来更像探讨。因为kg认识基本上所有人，所以每个人都可能被叫到回答，每个人都能说出些什么，kg每次的回答基本都不带否定，更多的是认可，或者说是尝试去理解我们每个人的意思然后加以引导、激发思考，这让我觉得非常棒。上到现在，我感觉体系这门课它不像之前那两个硬件课那么死板，说一是一，说零是零，它的本质是设计，设计本身就是一件灵活的事，为了进一步优化cpu的性能，并对于此过程中可能出现的问题有各种各样的措施去改善或者避免，而设计只是第一步，在实现上还会有更多的不同。当然，这样的多样化也增加了难度，而且我自己一直以来也没有接受过这方面的训练，不是很会设计，但上下来还是能学到一个设计的思路，迭代优化的思想。

说完体系，我也想和kg分享一下自己的情况，或许能得到kg的帮助xixi。

对于未来的规划其实我还是比较迷茫的。首先，我什么都知道一点，但什么都不专精，因为没有特别感兴趣的方向，不知道以后该做哪方面的工作，当然这不是说我啥也干不了，应该说是只要特别训练一下啥也能干。可是一想到以后就这样去修福报做996，997的社畜，就感觉人生特别的无趣，也没什么特别的价值。总而言之，就是我缺少一个驱动我大步向前的方向。在上大学前对计算机感兴趣是因为游戏，本来是想做一个游戏开发者，但是现在看来，玩游戏虽然快乐，但是做游戏有价值吗？因此我现在还在摸索，想找一个既能对社会或多或少有点帮助的又能用上自己感兴趣的东西的方向，而不是最后成为一个整天只是在糊业务代码的加班机器。

（本来还有些消极的，但是看完kg的这篇文章感觉又被激励了）

Hello, kg. I feel very lucky to learn computer architecture with you this year, for your showing me what a lively, harmonious class should be. Initially I choose your class just because the time is fit and a senior had just recommended you before. But when I get familiar with your teaching style, I got that you are truly treating us as friends and spare no effort to make us all participating in the class. Also the qq group is always very active and helpful(and you always @ me www).

Praising stops here, although there can be more to say. Below are some suggestions in my sight. Some content of architecture can be found in computer component class so there is no need to spend too much time repeating it. And experiment class seems separated from theory class, maybe you can refer to the experiment more in class.

For my plan, I may go to an Internet company for a technique position after graduation and achieve financial freedom before my 35 or 40. After that I'll have a big travel around the world, visiting the places I've dreaming for long. And pick up some interest like painting and singing.

To be frank, I've not imagined my future being a programmer before entering college. I'm confused like most freshmen at the first year and got the chance to major in CS. I've been always pursuing perfection before my 20s, so after I get countless failure in my work, I've abandoned myself for a long period. But thanks to the online semester because of covid-19, I got time to think what I want to do and remake my plan. I gradually get the trick in learning CS and find my pleasure in implementing a big project by coding. I hope I can contribute my effort to building an excellent game.

However, my parents put their expectation one me and hope me to go further education, and I'm a little in it. I'm studying hard to realize it but I think I should always prepare for the plan B since I'm not so outstanding among my peers. I did some leetcodes this summer and see some experience sharing post on some website. And I think I should try to find some experience in big projects to fulfill my resume.

For how to keep motivated, I know I'm not so outstanding, but I'm good at accepting my imperfectness now. At least I can complete my own work well and have a lot of true friends. Back to the way along, I find I've been changed a lot these years, stronger and can see the problem from a higher dimension. So when I find a problem hard to solve, I'll tell myself"the chance to change come." I'm confident in myself that I have the strength to turn things around like heroes in comics because I can always finish my work at the last moment before deadline(www).

Last, for the suggestions to offer, I'd like to share a old Chinese proverb" A loss, no bad thing or a blessing in disguise"(塞翁失马，焉知非福)。Whether the experience is painful or not, it's what you learn from it and what chance you see that matters.

Hope kg always happy and young and give us the chance to see ks this semester(xixi).

说实话，kg 你带给我的体验是挺特别的。

我本人是一个对集体很无感的人，在我整个小学至大学的人生中，我是一个与集体很格格不入的人，或许是从小学开始由于一些原因被排除在集体之外，到了中学老师希望我融入班级时我自己选择了放弃。虽然对集体无感，但并不是不爱交朋友。相反，我的交心朋友还是很多的。于是乎性格使然，在大学所有需要积极参与课堂来拿分的课程我的成绩都比较差，比如思修、马原、通核课程等等。

我虽然不喜欢参与到课堂中，但也并不讨厌别人积极参与的课堂，只是不爱举手说话，我觉得 kg 的课堂氛围是非常不错的，但那些我觉得都不是关键，主要是 kg 讲的好，而且同学也讲的好，我上课能学到好多东西。

关于未来我更想出国，但并非是攻读更高学位或者外国学术氛围更好致使我如此选择。一是因为 996，二是因为房价。这俩原因很重要，但是也不算是最重要的，主要还是因为我想要做游戏，而如今的中国没有那种我喜欢做的游戏的工作室，而国外是有几个的，有机会的话我想加入他们的工作室做游戏，哈哈。还是有点梦想的。

When I was in high school, I have great enthusiasm for mathematics, especially for number theory. But I didn't earn a good grade in the math competition and doubted my ability on math. After graduation from high school, I choose CS. At that time, I thought it is very cool, and is related to math. And I desired to earn good money. However, during the three years' study about CS, I found that maybe I not fit it. I just took the courses regularly, didn't get much inspiration, and have no motivation further study. To be honest, just keep up with the regular courses is a bit challenging for me.

Before long, It will be time to make decision again. I want to pursue further study in cryptography. It is more theoretical and involve much number theory. But I'm not so determined yet. In the cryptography course teacher said that it is very hard to make achievement in this field. And I'm quite shook under the employment pressure. (After all, make great money is one of my fewer persevered goals lol.) For my this uncertain target, I'm study some mathematics during spare time. And I also need to improve my English and prepare for postgraduate exam.

Finally, thanks for your words. It really insipres me, and reminds me to figure out what I really love.

After graduating from university, I wanted to study as a graduate student in the School of Computer Science at Zhejiang University. In my junior year, I had the honor to join Professor Xiaolin Zheng's laboratory. I am very interested in their projects such as recommendation algorithms and artificial intelligence learning platforms.

Now I am on the verge of becoming a graduate student, so I will have a lot of pressure in my junior year because this is the most critical year. Of course, if I can't continue my postgraduate studies, I will choose to work in a good company. In the summer, I participated in the ByteDance summer camp and had a good experience. And my java technology stack is improving day by day, I believe in my ability.

I am very grateful to Senior Pinhan Zhang and Senior Jiajie Su for providing me with advice on research. They not only provided me with academic advice, but also shared some competition experience. Under their recommendation, I have signed up for the China Software Cup early next year and the Discovery Cup competition at the end of this year, I believe my efforts will bring me a report.

Thanks to bro Kai's teaching, I became interested in the computer architecture class, and I also like this class group very much. This is all I want to say.

Dear kg,

I'm glad to share my thoughts here. As for my plan after graduation, I plan to pursue my master's degree abroad. Actually, I'm often asked about the reason why I want to go abroad, the true thought of mine is to go through a completely different experience. I believe being in an unfamiliar environment is a shortcut to growing, it will prompt me to think and change, just as my ideas has changed a lot after I went to ZJU. I'm eager to experience things that are out of my imagination and gain diverse perspectives toward the world.

This question reminds me of the career planning homework I wrote in the freshman year, according to the plan at that time, I shall have mastered Matlab, completed the TOFLE test, and solved hundreds of problems on leetcode—which in fact none of these goals are now realized. But it doesn't seem to matter, the intention of making a plan is not to follow it strictly, but to make me more brave and confident when facing changes. The most important thing I realized in my freshman year is, only a few people can stand in the center of the stage, but it's also very happy to sincerely applaud for others.

What I'm doing is not to chase the glittered result, but just stick to the path I chose, be diligent enough to make myself feel at ease and justified, and the reward will come naturally.

Finally, I would like to express my appreciation to kg for your guaidance and encouragement, that's one of my motivations~

Some problems are a little difficult to understand and I have left some comments. All the problems are good for me to understand more about the knowledge and the exam. I can see kg's devotion.

I did not do a good job in computer organization course. However, when I enter this class, I feel I know more clearly about it. Although I may still get confused when first drawing the graph. Another problem may be understanding the title. Although I can write something, I do not really know whether I have answered the question or not. For some of the problems about modifying a part of the architecture, my thought may get really different from the answer. So I am quite not sure about correct or not.

Peer pressure is huge. I know that many students have a better understanding than me. I dislike saying in class. Also, my question may be very strange and I want to think by myself. So I may discuss with one person instead of the whole class.

托福首考 102 是对我很大的鼓励。大的方向来看，应该是要选择出国了，除非真的运气好到保研掉我脑袋上了。

有时候，我很向往回到大学来当老师。我想在同学经历与我类似的困难的时候，我能减少他的焦虑并劝解他：和自己和解，你还有很多可能性，总是有可期的未来的。我想如果遇到了不合理的制度，我能从老师的角度尝试解决问题。我想和老师同学们愉快相处，一起去做点小有成就的科研。当然，我也比较喜欢看论文的感觉。目前来看，在浮躁的大学生活中，沉浸在一篇文章中，哪怕是用笨拙的方式去试图理解它，也能让我感到许久体会不到的宁静。

当然，我不愿意破坏自己的可能性。谁知道未来我想做什么呢？可能再过几年，我才能找到自己喜欢的事情。我希望可以在满足物质的基础上，能够快乐起来，并且能带给身边的人幸福感，就足够了。至于年薪多少，职位多高，我不想关心，生活过得舒服而纯粹就可以了。

One problem of computer science's class is the redundancy. For example, cache is taught in computer organization, computer architecture, operating system or even Database. This brings the teaching task much more difficult. Especially in computer architecture. When learning this class, the main task is about understanding pipeline and experimenting it. This is not sufficient for full participation in the class. Also, there's always a contradiction. For many students in college, the ability to listen to new knowledge has been gradually forgotten. They prefer to learn by their style. What makes sense is "verifying". This is the reason why quiz works well, even without a given score. Maybe, homework should be submitted before the knowledge taught. Then, having class will make a better experience(also takes more time in total).

As for the goal and plan, in the college, student's goal can be simply divided into 3 classes: Employment, master and Phd. Many students choose master in domestic, but to my best of view, the employment doesn't develop a lot for CS. Some students choose Phd, a harder way with unknowns ahead. For students choosing employment, some's reason is the failure of getting master. The result of their salary doesn't seem to be worse, more often, even better than a master at same age. "Li Hua goes to Huawei 996, Wang Mei goes to move bricks for her mentor. I go to make academic waste. We all have a promising future.". This is not a joke.

Thus, there's no clear boundary between these. The main factor to choose is one's interest, a even more unknown field for today's students. For me, impacted by some seniors, I prefer to go abroad and read Phd. Following:
- do something different and interesting.
- making changes.
- See more, try more.

I want to make life colorful, not just for job or salary. I want to keep these ideas as long as I can.

What make me confused is the field. I am working on CV now, finding heavy involution inside. The study is more like an arms race between groups and companies, though many of the following open source. The work doesn't need a lot of prior knowledge, encouraging more and more competitors.

Result of this not only make the study harder, but also brings a lot of meaningless work. In 2019, a new way of clustering come to the world. Then in 2020, over 10,000 papers are based on it. Much of them are just copying and following, even ones that make a increment work are rare.

So, what's meaningful? What's interesting? These are the questions which CV players, even AI players are often thinking of. There's always a tradeoff in choosing to make more paper or do some real work, like what we've learned in architecture class about CPU designing.

Too much about the future, so back to architecture class. What I want to say is that, It's kind of you to always be there to help us. You want to make the architecture class more interesting and making more discussions. I truly feel grateful.

Dear Mr. Bu,

Thanks for your writing and I'm glad to have the opportunity to communicate with you.

I'm very glad to have the chance to be in your class, and this is one of the most unique course experiences since I went to university. You are always full of enthusiasm and always encourage everyone. In addition to professional knowledge in your class, I was even more ecstatic that I also gained a lot of energy and an attitude of facing difficulties.

From where I stand, there remain two main challenges for I to learn this course. First, my English is poor especially speaking and listening. I don't have big problem with understanding what you are talking about in class. One of the reasons is that the slides are very clear. I can grasp the knowledge in writing well, but it is difficult for me to understand some of the sentences you said verbally. Your spoken English is very outstanding, not only fluent but also very clear. But because your intonation is relatively calm and my English listening is poor, I sometimes get distracted easily. In addition, my oral English is very poor, and I don't know how to express professional problems even more. Besides, I am a very introverted person. When I was called in class, I was very nervous, my brain was blank and I didn't know how to express my opinions. At this time, I was worried that it would delay class time. I am a person who needs to be fully prepared to express myself, so the questioning session in class made me a little nervous.

Your class has been very satisfactory, but I still have the following two suggestions. The first is whether it can be emphasized again in Chinese in the critical part of the classroom. Because teaching in English is still a bit stressful for some students, and proper emphasis can make students more concentrated. The second is that homework assignments can be arranged in chapters. Because the amount of homework in half a semester is a bit large, and the assignment of homework in each chapter allows us to timely check the knowledge points we missed in our study and strengthen our memory.

My plan for the future is not very clear. My favorite destination in the future is for postgraduate recommendation. But my grades are a little bit dangerous, so I want to work hard again and again in junior. At the same time, preparations for going abroad for future study are being made. What I will do is to improve my grade point and improve my English. I also want to study with a teacher to do some research.

Finally, I am really happy to meet Brother Kai. You are a really really good teacher. You really give students a lot of autonomy and opportunities for communication. Thanks for reading this letter.

Best wishes. Wish we all have promising future.

For the future, I hope to continue studying for a graduate degree. There are two ways to achieve this goal, one is to pass the exam to enter the school, and the other is to recommend. Because many students chose to continue their studies at Zhejiang University this year, I may need to take an exam.

In the past, I was a relatively casual person, and I learned assembly line technology in the computer system course. This is a design that pursues efficiency and is well-planned. Maybe I also need such characteristics.
For myself, I hope to be an ordinary and great person.

Hi dear kg!

When writting this special "solution", I'm currently sitting aside a table of barbecue shop right before the deadline lol. I feel very sorry for showing my procrastination skills so many times but I can not deny it this is my real situation and state. But I'm still trying to get alone with the deadlines and courses information.

My goal after the graduation used to be very clear. I participated in high school student olympics on biology 3 years ago and listened a lecture on computational neuroscience given by a professor, Louis Tao. I was infatuated by his devotion, contentedness and passion when introducing his work, belief and the so called "the beauty of science". I thought modeling the behavior of neuron system is very fantastic and fascinating. And I choose computer science largely based on an advice from a neuroscience undergraduate I known from internet. As a video you shared, the host quoted that "Advice is a dangerous gift." It (might) turned out to be a more suitable choise that I went to learn physics at USTC because computational neuroscience requires strong skills of leveraging mathematical tools and insight of neuroscience, both of which are what I'm lack of cultivating. So this option seems to be leaving from me now. But I also think it could be like any other illusion or impulse a teenager can have.

So currently I'm kind of interested in CG and preparing for finding a lab (yeah I'm procrastinating all the time hhhh) And I do enjoy the moment of devoting. This feeling is as same as the first time I used python to catch the flag in a newbie QSCTech exercise at 2:00 a.m. before my college begun as hacking for an awesome program (or beginning a homework rushing before the deadline). I do enjoy the devotion and I do love the beauty of algorithm and those great thoughts like abstraction. And I think my biggest question is not taking actions and not making reasonable plans. Yet I think this problem is pretty common. Long long way to go but I still feel the pressure.

And for the course, I think the lab could include the using of advanced tool currently in this area maybe? Like OS now teaches (or tells us to self-learn) debuggers, qemu and docker, which are really close to the forefront of system design and research. And biggest problem I met in CA is that I'm enrolled in too much courses and I can't keep my rhythm from being corrupted by some distractions like some social events where there are many fantasitic friends I want to met and communicate with, some emotional fluctuations and procrastination. I have to confess that I learned many concepts right during finishing the homework rather than at the lecture TAT.

And best advices I received in college are as follow. First is that computer science is a very young and open area so it is possible for everyone to learn almost everything he want to know about computer science. There are many open courses and textbooks one can exploit. It is the motivation and efforts that drive one forward. And the second is that one should build the big picture of what he is learning as soon as possible, which is very helpful for freshmen I think.

So wish everyone could be lucky enough to have something to kckc for and could have the effort and passion to kckc all day everyday!

Well, though it might sound disappointing, the truth is, all I want to do is balancing my own life and my life in my father's imagination. I guess this answer can be kind of strange and embarrassing……

In January 2020, I broke up with my ex-girlfriend. Though this could not be the only reason for the great change of my personality, I have to admit it becomes much more difficult for me to find the meaning of life, or the custom-designed mission for me in this fantastic world, after the ending of this relationship. I used to dream of becoming some programmer before, however in the introspect after the breakup, I gradually realized that the daily work of a programmer does not seem to be some component in my dream life; the high salary could be something excellent, though. It is the uncles or aunts from the last generation in my family, or in the society – represented by my father – who consider the beautiful life in Hangzhou, or Shanghai, or Beijing something charming. Well, as far as I am concerned……2 years' life in Hangzhou doesn't seem to successfully inspire my love for the metropolitan life – no negative emotion, either. Life in Hangzhou is greatly different than life in my hometown, Yongzhou, which is a very small city in south Hunan; however, it will be hard for me to decide which one is better – there are movie theaters in both cities, and thanks to the development of Internet and the construction of network, I can purchase whatever I want in Yongzhou, just like in Hangzhou. In Hangzhou I will be able to go to Huanglong stadium to watch some live shows, if I can luckily get some of the tickets. With all of these…… maybe my life has been complete. That is why living in which city doesn't matter a lot: my request is never a lot.

The same is true for the job as a programmer, or an excellent programmer – those with less hair. It pays a lot, and with more money I can buy more what I want to purchase, and for my father and all my dear uncles and aunts, having a business card with great titles seems wonderful – well, I think it is cool, too. But, how to say…… it is good, but maybe not a must for me. I will be happy if I become a great AI scientist, but if I'm just a normal programmer, or if I'm enrolled in some other kind of jobs, maybe I won't feel disappointed, if I still have chances to read the books I want to read, or to play the video games I want to play. It is easy for me to feel satisfied, since the curiosity to explore the world has been lost – just staying at home and having everyday simple is OK. As what I mentioned before, it has become hard for me to find the meaning of my life. It is OK to keep myself lazy, since I have no dream to achieve. That is the question. If I have no outside pressure, it will be OK if I directly go to work in some IT corporation, or some other places if my coding ability is not good enough (at that time I may regret of the time I waste now, but at least now it is happy for me to waste my time on video games……hahaha). But now with the heavy expectations from my family members, and sometimes myself – to earn money so as to enjoy my life or to keep my self decent so I will find my second spring in life – I will have to work hard and say goodbye to my video games temporarily, though not long. It is something tough for me to keep my life

balanced between my laziness and others' expectations. When I'm working, I miss all my babies in my Steam library; when I'm playing video games, the projects and labs in several courses make me hard to enjoy. What a dilemma! wuwuwu.

发现好像写啥都可以的样子。

首先讲讲对课程的反馈。关于作业：我还是挺喜欢做作业的，会有一种"啊我原来确实学到了些东西"的感觉。课程布置作业从来不是一件坏事（只要量合适），对于 ddl 我觉得能严则严，遵守规则是一件好事，这样可以督促像我这样的懒虫学习（虽然我还是拖到 ddl 了）。关于课堂：个人认为凯哥可以更相信自己一些哈哈，很多知识能坚定地说出来给我的印象会更深刻，中途问大家太多，我可能会忘记刚刚讲过的重点。我并不是反对课堂互动，就是互动的方式上可以更加高效一点（ie.课堂闲话少一丢丢，课间聊天让大家精神 hhh~）。

谈谈我自己的话，其实现在还没有什么目标。我好像不是那么自觉的一个人，但是选到的课还是会好好争取绩点，平时也可以把自己照顾好，生活上比较满意。虽然也有不少身边的人觉得我很强、我可以做很多事（毫不羞耻），但其实我也不想争那么多，经过大一大二之后，我越来越向往平静的生活（佛系）。自己做到的，和我自己所设想的，差距比较少。对于这门课，我的兴趣其实没有很大，会老老实实完成要求！

嗷开学自我介绍的时候好像说过自己擅长考试 hhh，分享一点点我的学习经验：1.充分利用课堂，尽量不要课后再去补 ppt 的内容，可以一边听讲一边看看体系/组成的书；2.对于课堂例题，一定要搞懂+关掉能自己做的程度；3.考试周前复习多去 github 上 qsc 的课程共享计划里翻翻往年试卷和微雕作品之类的，做题的时候保障正确率（速度是熟练度提升之后养成的，个人倾向先提高答题质量）；4.充分利用错误，不管是课堂上想法的错误（或者是带给你冲击的知识点），还是实验中的 bug，还是刷题时的错误，每次遇到了一定要保持警惕（肯能有思维定式），每次遇到了可以简单地记下来，考试之前多看看。嗯，差不多这一些，虽然看上去也没什么特别的地方，但是做起来还是挺不容易的。另外有一点，希望大家对自己有一个正确的认识，不要期望过低或者过高，保持好心态！

最后是夸夸环节！（其实我不太会夸人 hhh）凯哥肯定都听腻了，月饼、零食、奶茶，能在课堂上享受这些真的很惊喜！也祝愿凯哥能在自己的科研领域有所成就！最后还是再说一点建议，合适的严格是一件很好的事！

我感觉体系好难啊，这些题目做了我四天。做这些题的过程就是我反复查 PPT，看书的过程。这些题目有的是问定义，比如 234 题这种，我的感觉是找 PPT 上对应的话和注释理解一下回答。还有就是课后习题和书上的例题，我也是参考了一点点参考答案的。。比如那个 64 位的数存寄存器的 14 题，我不太知道咋写，之前计组课也没然后我看了下答案是用 SD, LD, DADDI 这种，然后第 22 题我感觉答案有点问题，也许是我的理解有问题。反正有的题做了也不太懂，大部分还行，有的题目意思我可能也没懂。

感觉收获还是挺大的，毕竟我是一个上课不怎么认真的人（一般要靠课后再学），然后作业会激发我学的动力，如果没有作业的话我可能就要拖到考试之前学了。后面要好好学了，认真听讲做作业做实验，不然要完了。

To be honest, I am still in a confused stage for the future. During the University, I learned a lot, but I didn't have a deep understanding of my own development goals. I feel that at present, I just have a wide understanding, and I don't have a deep understanding of many things. Or from what some of our predecessors have said, there are many directions for the development of computers, which are very promising at present, which is very optimistic. But there are also some seniors who have graduated from work and talked about 996 and become very sad. It will still be in a state of chaos.

Now I'm working on SRTP, and I'm working in the laboratory of our school. I found that what I want to use is not at the same level as what I am learning now. It is not only a kind of promotion, but also a kind of pressure. Fortunately, I am more interested in the research. At least for the moment, I think we have to go to graduate school after college. Going abroad is not so important to me for some reasons. At present, however, it seems that a 4.5 GPA is needed to guarantee the postgraduate entrance examination, and it seems that it is necessary to prepare for the postgraduate entrance examination. So it's better to study hard now.

About my goal after graduation.. Hmmm I'm not going to work in an company after four years of university. Ideally, I aim to continue to study and do research in the lab. But to be honest, I am also not entirely sure that doing research is suitable for me. Maybe my consideration will change or maybe I will regret my choice in the future XD.. Choosing something is always difficult for me and it seems that I have already changed my mind many times since I enter university... So it is possible to change again.

About my plan, I hope that I can obtain the postgraduate recommendation after this year, but this is again not sure for me (it seems that nothing is sure for me = =). As the number of recommendations changes year to year and I'm not the top 5 students in my own class, I can only strive for the postgraduate recommendation, but there is no guarantee. So I'm wondering what kind of second-hand preparation should be done, preparing for the postgraduate entrance examination or going abroad. HK and Singapore are both good place to go, but I prefer to stay in China, hmmm... I'm still struggling with this point. I just consulted with another teacher about this last week, and I need to make a decision as soon as possible recently.

用中文说一遍，表达清楚一点：

我觉得我在决定这件事上特别纠结，尽管内心有一定倾向性，总也不知道什么才是对自己最好的选择，即使是目标明确的深造，摆在我面前的也有三条路可走，当然不能全部准备，每一条也都不是十拿九稳。如果要说对学弟学妹有什么建议的话，大概会劝他们从大一就看明白保研政策把成绩做好一些吧，这样至少保研的路是稳的，其他的更有底气去考虑一些。

最近也要赶紧决定我自己的二手准备是什么啦，尽管这段时间试着问了很多身边的老师同学，不过这种事果然还是要自己做最后决定……其实还是比较迷茫的，到底应该选哪个好。需要尽快想好并且去做准备吧。

凯哥您好：

思索再三，我还是决定用中文给您写这封"信"，我还是有一些真心话想跟您说的，但本人的英语能力着实有待提高，因此还是用中文来说比较方便。

首先关于您的课程和教学内容，我是觉得挺好的，我很喜欢您的授课方式、教学内容和课下工作量。您的课程相对来说轻松一些，作业量也没有特别大，课堂氛围总是比较轻松。相较于大三同一时段其他几门主修课那繁重的作业和实验量（特指操作系统），以及大量的课内知识（特指计算机网络），我更喜欢体系结构一些。这样说并不是说您的课程水，而是我觉得这样的授课环境才能让学生真正有时间自己思考一些东西，至少我自己在上体系课的时候还是比较专注的，而不是在某些课程上一直在思考实验应该如何做。不过英文授课对于我来说还是有些困难的，在大量的英文面前，加上周一早课的因素，有时候不可避免的会犯困，不过在我清醒的时间，我始终是在跟着进度思考的，并且也在课上回答了几次问题，不知道凯哥记不记得呢哈哈。

另外凯哥既然问道毕业后的打算这个话题，那我还是有蛮多想说的要说的。我在还没进大学和刚进大学的那段时间一直希望自己未来能从事科研行业，因为我的父母都是大学教授，从小在大学中长大的我也想象不出不从事科研的生活会是什么样子。我以前一直抱着一个"崇高"的梦想，便是从事科研，为中国乃至人类做贡献，于是就顺理成章的在大二联系了导师，在大三进入导师的实验室参加组会，然后发现，科研实在是太枯燥了。不光是如此，有时候我也在怀疑，我真的适合科研吗？如果我进入科研行业，我真的能为这个领域做出贡献吗？仿佛90%这个行业的创新都出自于那10%的人手中，而我不想自己碌碌无为，做一些改变不大的工作。我想做一些更大的事。因此我慢慢的我将目光转向做产品，如果自己不能为领域做出突破贡献，也可以做一些产品服务大众，这样也算是实现了我自己的价值。（这里强烈推荐阅读《乔布斯传》）目前自己的想法还是希望能够读研，如果不能保研，我可能会去尝试做一个产品经理。

我在刚进大学的时候给自己定的目标很高，然后压力特别大，门门课都学不好。后来仔细想了想，觉得人各有志，这个行业内卷如此严重大不了我换行业，每个人都有擅长和不擅长的方面。于是后来就不那么在意成绩，也不给自己那么大的压力了，成绩反而变得好了。因此，就像我在体系第一堂课上自我介绍说的，我没那么在乎（当然也不是不在乎）体系课的最后绩点，我更希望学到有用的知识，而在现在的课堂上我学到了我以前不知道的知识，还学到了许多其他同学的学习方法和学习状态，可能唯一没学到的就是水群吧......我已经很满意了，非常感谢凯哥！

其实没太看懂要写点什么ao，一开始以为是需要一些对课程的建议，后来又看到似乎是需要写写自己在这个阶段的想法？

mmm 我一直很坚定想要做科研，自己也是那种比较自闭，不太聪明，但是比较踏实耐心能吃苦balabala的类型，至少希望成为这样的人并且一直在努力，所以觉得科研比较适合自己。而且上学读书到现在，一路上遇到很多学校的好老师和虽然是学长学姐但是给我的帮助完全称得上老师的人，我自己是个很普通的人，如果没有他们的帮助是没有办法一路到浙江大学，经历这么多有意义的事情和挑战，学到这么多有意思的东西的。因此也希望以后我能成为像他们那样为后面的努力的人帮上忙的类型，换句话说，希望能成为老师。从这个点出发，也希望自己能够走科研这条路，不一定要自己做出多大的成就，但是想要努力带学生。

但是到了大二大三才开始逐渐觉得其实不是自己想的那样顺利的。看别人走科研的道路，仿佛本科期间发几篇文章，顺利考托福，报暑研，夏令营，交换，然后有一个好的学校，好像是一步一步很自然的事情。但是到自己走的时候，每一步都好难啊。虽然选好了导师，但是几乎被无视了，虽然能够理解导师太忙，自己不够主动，但是心中还是有怨念的。SRTP也完全没有指导，全凭自己摸索，找实验室的学长要一份数据都要好几天天天问天天催，自己又比较社恐，真的很难过啊。好不容易参加的实验室项目，到结束都没有写过一份代码，也没有被叫上开过一次组会；好不容易联系上导师问有没有可以做的事情，却被安排了不伦不类的工作，mmm，室友听说了甚至直接劝我换导师。拖到现在，科研真的毫无进展，其实心里很不服气，总觉得不全是我的问题吧，总觉得我还是有一点能力的不至于如此的吧。

但是解决问题永远比抱怨重要。最近也在想，大三其实是最后能够去确认自己喜欢做什么方向的时候，其实可以到不同的实验室到处看看吧。另一方面，出国不那么靠谱的情况下，也想考虑在国内其他学校去保研。其实还是有很多难得的选择机会可以去考虑去努力的，但是自己心态和情绪都还很混乱，总是打不起精神去做这些事情。

本校保研，以前一直当作一个最后的退路来看的，现在就，唉，其实还是不稳。虽然成绩很好，但是代价是各种学生工作一类的事情都没有做得很好，保研分数会被扣；科研没做好，保研面试也不知道该怎么办。但是乐观一点想，至少我成绩好耶。然而转念一想，现在这么颓丧，这学期不努力，一旦考差成绩还不是就差了。总之也还是很焦虑。

初二，高二，大三，这三个时候，其实自己都出现了心态上的问题。好像有了一些成果，可以去冲击更高的东西了，但是够不着；可以放松一下了，但是好像松不得。每次都想着要规划好自己的生活，但是最终过得就是一团糟。回首过去的两年，好像错过了很多的机会，又很多要后悔的事情，不论是选择不对，还是自己不够努力。但是生活没法后悔，而且真要去算，我觉得还是有得必有失，这两年也不能否认有很多宝贵的收获和成长。所以还是向前看，嗯嗯，把SRTP继续做下去，不伦不类的工作也做下去，找个时间找班主任问问给我点科研做/外校保研的情况/出国的建议，继续关注交换，继续学托福，以及最重要的，认真对待现在上的每一门课，把期末考考好。

唉话虽这么说我还是好颓好难过，kg有什么建议吗。

谢谢kg花时间看这些东西，其实觉得kg就是我理想中的老师，我想要成为的那种人了。日常羡慕tyy的导师，真的很暖很helpful。

I truly appreciate kg's attitude toward learning, teaching and living and to be honest, it is the first time I focus on hardware courses sincerely XD.

It is really a different world from what I've learned before. It is intriguing while really hard to adapt(especially for me who didn't learn CO hard).

Well, I think it would be better to assign homework more frequently with less problems one time, since we always do it before DDL. It is bad habit but really difficult to break...

To be honest, having presentation is a great experience but it is almost impossible for us to understand other groups' points.

I did have fun in CA class!!!

(I highly recommend kg to have an assistant however)

1. What do you think is the real challenge for you to learn this course?

   The real challenge for me is that I don't get into the habit of previewing the slides and textbook. Therefore I kind of fall behind when you delivered lectures in English. For sure, your spoken English is excellent, but I can't get your ideas as quickly as you say it in Chinese. Although it's mostly my reason, I sincerely hope that you will lecture more or all in Chinese, please! 😫

2. you consider interactions in class helpful?

   Yes, it is. Except for sometimes, I can't hear the conversation between the teacher and the student.

3. What held you back when you were trying to ask or answer questions in class?
   I am too shy and afraid that my answer is wrong.

4. What suggestions (for better learning this course) would you like to provide to other students?
   Read textbooks and slides more. Discuss with friends more.

As you put it, the third year cannot be more decisive for my future. However, I always feel confused and unsure. Sometimes, I want to be an engineer in an IT company and produce something. And sometimes, I feel like diving into research about social networks and behavior, in which I am very interested. And last night I began to think about which one is the way that I will not regret to take. And now, my preliminary decision is to get a higher degree, and I plan to get in contact with my target research lab. The biggest obstacle is that my homework is too much in the winter semester, and I am way too lazy. I think the first thing I should do is to overcome laziness and finish my homework in advance.

In the end, **thank you kg**, I will not hesitate to reach out for help in the following days if I need it.

Feedback

This semester of *Computer Architecture* has been a pleasant journey (~~and not just because there is no weekly homework~~). Though pipeline is a serious topic, but the relaxed vibe was filled in that classroom, which helped me to be more concentrated.

The presentation in the beginning of this course is something I enjoyed. It gives an opportunity to learn what's new in architecture, learn about the latest development, and have a rough understand of what researchers are doing in this field. Besides, I like English public speaking (the kind that needs preparation, not in class quiz), and this presentation gives me the chance to do that.

From my point of view, I did think that there could be more labs. So far only one pipeline related lab is assigned, and only limited work to do in it. I think it won't make enough impact on my memory, compare to if given a chance to do more practical work. I think some labs in course *Computer Design* and *Logic Fundamentals are unnecessary,* but in *Computer Architecture*, they are not enough. (Please don't let anyone else know this….)

About Future ….

I may have an ambition to get a PhD when I was a freshman, but after the painful experience in the past year, I think I'll be more realistic.

I now decide to join a major IT company after graduation, and give up the idea for further education. My plan was to become a posted developer, since I don't really like frontend. So right now, I focus on LeetCode, get some experience on iOS development, and prepare myself with whatever is need for that job.

Internship in next year's spring would be my current goal. Get any offer from Ali, Baidu, Tencent, or Byte Dance would be good enough.

But things might go my way, I am indeed a little late for preparation. If none of the company would accept me, then a smaller company is also acceptable. Maybe gain some experience, and then apply again.

That's it, my current plan for future. I have encountered a lot of disagreement, arguing that I should at least get a master degree. But I really don't want to continue to be in a school, go get a job might not be the worse idea. Besides, in worst case scenario, I just be a robot in an IT company, living a mediocre life, right?

　　这题我决定用中文回答。关于毕业后的目标，我唯一能确定的是会读研究生，至于是读硕士还是博士，我尚没有想法，或许也由不得我。

　　大一的时候，出国的意愿十分强烈，当然随着美对华政策的变化，看到朋友圈有学长的签证被收回以及我的表哥(同在浙大)申请哥伦比亚大学转浙江大学硕士研究生，我个人认为出国的风险很大，并且对我来说，不去美国读计算机的话，似乎没有出国的必要(之前跟朋友讨论，*ETH* 本身也是很好的选择，但是近两年卷到爆)。对于这条出路，我目前的想法是考了托福和 *GRE* 再议。

　　保研也是一条理想的出路，甚至是目前我更倾向的目标。我个人觉得安全是很有意思的话题，想必如果读研也会继续走这个方向(系统安全)。但是，迫于专业人少，相对应地保研名额也少，竞争就激烈很多。大二我的均绩排在专业第 8 名，保研名额只有 5 个，这是目前的最大困难，也是我感到十分焦虑的点。我本身不想再经历考研，这种千军万马过独木桥的形式，我只想经历高考这一次，当然也由不得我，没能保研就只能考研(或者跑路出国 qwq)。

　　目前，我在纪守领老师的 *NESA* 实验室下的系统安全方向进行科研训练，老师希望我去做 *Fuzzing* 方向，可以说是困难重重。之前我问了相关导师一个问题，就是科研的基础知识是该边学边用还是学完再用，因为 *Fuzzing* 需要静态分析和动态分析的基础，我个人倾向于后者，导师给的答复是前者。这让我对自己做科研的能力打下一个问号，边学边用似乎不太适合我，我个人喜欢将知识全弄清楚再做进一步深入，当然，这也可能是我逃避科研的借口。不知道凯哥您怎么看，或者换个问法，如果是边学边用，如何去搜集有效信息或者有效提问，不知道凯哥有什么建议？恳请指点迷津。这点对我来说很重要，因为之前打 *ACTF* 我遇到的最大困难就是不会搜索有效信息，导致找到真正有用的信息花了很多时间。

　　说来惭愧，大一的时候曾经邮件找过凯哥，问了信安的发展方向的问题，到了大三仍是一头雾水。学习对我来说，是一种高中沿袭下来的惯性，似乎不会遇到学习动力的问题，即便有，也是间歇性的，核心问题还是对未来的不确定。

wow. ~~This solution is without google translation. So...sorry~~

Okay, I can't finish it without google translation. 🙁

First,about my goal after graduation.I hope kg carry me to graduate 🤣

I think I want to get a higher degree, just because my parents want me to do this.Actually, I still don't have a clear goal of my own.Perhaps I better like to work in company after graduation? God knows.

However,I think sometimes have no goals is not a bad thing. At least,I can try another way when I failed in one direction. So I meet the status quo.

At the same time,have no goals doesn't mean I don't do anything.On the contrary,I devote all my energy to various things beyond study.Such as,working,do projects in some Labs... I think it is enough that I have something to do everyday.

Second,helpful advices or suggestions.mmm.The biggest advantage is the homework answer,include some codes 👀.Also,I think they bring me more opportunities. When I fist meet something, I ask my senior students subconsciously.They indeed help me a lot in my college life.Also,I met some professors very friendly, like kg and Pro.Wu. I come to ZJU luckily,and meeting these people in ZJU is just like a dream.

Third,suggestion~ Don't let you do nothing every day, take action!

First of all, I would like to express my views on this course. About this course, I think it has many contents similar to the knowledge of computer organization. But I think it is very necessary to review these knowledge again. A knowledge repeatedly mentioned by different courses reflects its importance from the side. The key point is that the two courses have different emphasis on these knowledge points, so they need to be distinguished. With regard to my future plans, I don't think I will go to work immediately, but continue to study for a master's degree. Computer organization is one of the subjects of postgraduate entrance examination, so I think it is very important to learn it well. Through the course of computer architecture, I can more deeply grasp the knowledge related to computer organization, and get in-depth understanding in some aspects, which is beneficial. Of course, both courses are very difficult for me. Compared with reading textbooks or PPT directly, doing after class questions can help me master knowledge more deeply. For me, the big problem with this approach is that I can't always find a detailed explanation of the question, or I can't understand the meaning of the answer accurately. This may be related to the fact that these two courses are taught in English and I need to improve in this respect. Finally, I think the computer architecture is more interesting than computer organization.

关于这门课。

体系结构不是信安的必修课，当时选这门课的原因有两个，第一是感觉硬件这块儿组成只学了一小部分，还是得通过这门课继续进行学习；第二是因为选修模块一我一分都还没有修读，毕业要紧，就赶紧选了，连带着《汇编与接口》。选老师的时候，也确实有查老师评分的因素，但还是比较佛系的，感觉学知识主要还是靠自己嘛，老师只是引领的作用，倒是 zbgg 在班群里强推 kg。

上学期的组成课是我上大学以来上的最难受的一门课了。作业很多、小测很多、节节课拖堂、老师经常性地弄不好钉钉直播、讲课磕绊，没什么逻辑、讲 datapath 的时候把自己弄晕尬了几分钟、总是说自己也不知道考试范围，再加上最后的实验是返校两周弄完的……于是我只能自以为是的自己看书学，但不论是最后的期末考试还是现在的体系课，都让我发现自己的基础太不扎实了。比如体系最开始的几节课，老师提的几个点大家都说组成学过了，而我有的只有些许印象，有的竟然完全没听过，实在惭愧，看书还是不认真。

上体系课的时候，老师有时候就会问大家是不是组成学过了，然后那些很懂的同学就说学过了学过了，都会了，但是有些点我确实还不太会，我也不敢提，也不知道是不是全班只有我不知道，我就低头自己看 ppt 和教材，结果当我把这个点看的差不多的时候再抬头听课，发现老师的 ppt 早都不知道翻到哪里去了，然后接着老师讲的看，就有点断片儿了。希望自己能在课后尽量多看教材，提前看看 ppt，虽然好难做到。

然后就是老师会请同学们回答问题，首先佩服那些同学学的太好了，讲的也好，条理也清晰（比组成老师讲的好），但是因为确实离得远，有的时候就听不太清楚，一句话听一半儿这样的。所以希望老师以后在同学们回答之后能再重复一下要点，因为老师有麦克风，会更清楚一些，谢谢老师。

还有就是老师讲课我有点听不清。我本身英语不差，听力也不错，但不知道为什么就是听不清老师讲的内容，每次课都立志认真听讲，但听不清我就很容易走神，真的很愧疚，也许老师可以吐词再清晰一些？我也得继续加强我的英语听力能力。

还有就是我们的实验，我发现每个老师的实验 ppt 好像都不大一样，老师课程网站上提供的 ppt 我觉得还有可以补充的部分，比如实验 2 以及后续实验的汇编代码。我们做实验只看到了机器码，然后我从朋友那边的 ppt 有看到汇编代码，虽然说这部分其实可以自己写，但是感觉还是方便了许多。

最后就是很感谢老师的平易近人，让 cj 也敢问老师问题，非常非常感谢！以后也会继续问问题的，希望老师不会烦！也超级感谢队友很积极地跟我一起讨论问题！

关于我自己。

对于比较近的未来，我的打算是国内深造。出排名前以为自己是保研边缘的人，出排名之后才发现自己是边缘之外的人，而且跟前几名同学差距很大。虽然蛮多学长学姐以及同级朋友都觉得我可以的，而且还有小一年的时间，但我还是觉得差的太多了呜呜呜。因为成绩不行，所以要参加明年的考研，虽然有学长说科班考研的性价比不高。学校的话，之前听学长说浙大太难考了，北大稍容易一些；也有认识的学长外推到中国科学院大学，作为北方人非常想考回北方，觉得都可以暂定为目标。但是又听说北大很难，中科院那边的学长又极度劝退，同时依然认为自己考不上浙大，所以还是没太想好。准备寒假就开始复习，希望自己最后不会没有学上。还会是 cs 相关，但方向的话，也没有什么想法，因为自己做事太慢了，周老师的 os 作业也有些难，每次都要做好久，以及还有其他的课程，总之就是感觉课业压力大，所以迟迟没有进实验室搬砖。srtp 倒是有做，但可能是现在做的太浅了，感觉没有开始的时候想的有趣。虽然大三下还要准备考研，但我依然希望自己能够找到有趣的事情，跟

学长和老师一起探索！

　　对于稍远的未来,假如我能够发现自己的兴趣点并乐于继续钻研,那我会乐意继续深造；如果没有，我会选择在硕士毕业后参加工作（；如果没考上硕士研究生，这个结局我暂时还没敢想）。说实话，上大学到现在，感觉自己始终没有找到与专业相关的兴趣点。就是说，我不抵触我所学的,我也觉得我所学得一些知识蛮有意思,我也乐意与小伙伴们分享与讨论。但是，在我闲下来的时候不会去钻研相关的东西，比如像有些同学开发 app、打打 ctf 什么的。而且，我也没有竞争心态和功利心去为了什么什么而钻研。相反，我很愿意去练琴，小提琴、古筝、钢琴 etc.；我愿意去学外国语，法语、日语；等等，虽然其实现在也没有怎么去学了，练琴也是隔三岔五。此外，我很抵制 996、大小周等等这样的加班现象，所以未来应该会去上下班正常的企业，我需要时间来满足自己的兴趣爱好~

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Thank you sooooooooo much for all the things you've done. Computer Architecture is difficult for me, but you've made it a lot more interesting. Though there is still something I haven't mastered, I've been enjoying the class.

For me, some practice on a daily basis will be helpful (but if there is no assignment I won't do myself). So if I were to make a suggestion, I would say please divide the assignment to several parts and assign them as soon as one unit is finished.

As for other part of class, I think interacting with us helps to activate the atmosphere. Though I am afraid of answering or asking questions in public, I enjoy it when other students are expressing their ideas bravely. It makes me feel the passion to study , to explore, just for the knowledge itself. Another highlight of this class is that you prepare presents and surprise for us, and it's heartwarming. Thank you again.

For the next part, I don't really have a clear plan for my future. I am still finding my path and at the meantime trying different things. I do have an ultimate dream but I haven't found ways to realize it. When seeing my classmates working so hard and so determinedly towards their goals, I always get confused about my future since I don't even have a thing to work on. Maybe everyone has his or her mission on the world and I am one of those who find it late?

The suggestions I want to give to my peers or someone younger are that:

No matter what circumstances you are at, you always have a chance to choose. If you can't choose your major or courses, you can choose the way you face them. If you can't choose a less stressful environment, you can choose not to give yourself much pressure.