



# Essential Experiences for Computer Science Graduates

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## Abstract

“There’s never been a brighter outlook for young computer science students than today” [5]. Technology has been growing so drastically over the last few years, but higher education institutions do not graduate fast enough to meet the job market demands. Many industries and organizations have open positions that can’t fill simply because they are not able to find the right person for it. Computer science graduates have some of the highest starting salaries and are in such a high demand that they can pick and choose the type of job and industry they wish to work for. This is because there has been a steadily increasing demand for bright graduates in all areas specially data science and cyber security. It’s important for graduates to stay up to date with the latest trends in computer science research, gain hands-on and teamwork experience, and be good problem solvers before graduation. In this paper, we will elaborate the steps that should be taken by the institutions of higher education in order to graduate students with this type of quality.

## Introduction

It is reasonable to say that “There’s never been a brighter outlook for young computer science students than today”. Technology has been growing so drastically over the last few years, but higher education institutions do not graduate fast enough to meet the job market demands. Many industries and organizations have positions open and can’t fill them simply because they are not able to find the right person for it. Computer science graduates have some of the highest starting salaries and are in such high demand that they can pick and choose the type of job and industry they wish. This is because there has been a steadily increasing demand for bright graduates in all areas specially data science and cyber security. Because of this shortage, industries may have to hire under qualified people and train them to come up to full speed. This training process can be very expensive for the employers. To avoid or at least reduce this training period and make the employment more cost effective, higher education institutions need to make sure their graduates stay up to date with the latest trends in computer science research, gain hands-on and teamwork experience, and be good problem solvers before graduation. In this

paper, we will elaborate the steps that should be taken by the institutions of higher education in order to graduate students with these types of qualities and be more prepared for the job market.

### **Hands-on Exercises**

The learning style for current generation has changed. Experience shows that many students do not spend very much of their time on reading textbooks. They do not enjoy reading the theory, but they really enjoy learning by doing. Working on homework and exercises is not appreciated by them but they really like implementing the projects and have not seen they complain that there are too many projects to do. While they are doing the projects, they don't mind reading different resources to come up with the solutions for their problems. So, a good portion of student assignments can be project implementation that they gain good hands-on experience. Our computer science department advisory board meets twice a year. The members of this advisory board are from industries and nearby universities. The purpose for having advisory board is to learn what the needs of the industries are. Inputs from advisory board members help us to improve our curriculum accordingly to satisfy their needs. A comment from members of this advisory board indicated that newly graduated student can write codes, but they can't solve problems. To address such an issue, we decided to spend the last week of class time on solving real world problems. To do so, we select some programming projects among old ACM programming contest problems from the website [ICPC.org](http://ICPC.org) [1] and student practice on them. This is done in our Data Structures and Algorithms classes.

### **Teamwork Projects as Class Assignments**

There is a high probability that when the graduates get hired for a new job, they are going to work as a team member on reasonably large size projects. Everything is new to them, working environment, supervisor, team members, projects, etc. It is very crucial for the newly hired employees to know how to get along with other team members and colleagues and tolerate the differences among themselves. It has been seen high quality students may not be very successful if they can't get along with other team members. To be productive, they need to understand the new situation and cooperate with other coworkers. This qualification does not come together in a few days. Students need to gain this type of characteristic gradually by practicing teamwork at school. Therefore, it is recommended that the students get some teamwork experience as class

activity before they graduate. Selection of team members for each team is important. If the team members are not selected carefully, it can become problematic and some team members may get free ride. To prevent such a problem, some tools are available that can be used for team member selection.

### **Capstone Projects**

Before graduation, students may work on a senior design project. This is a project supervised by faculty member(s) which can be one or two semesters long. Students may need to do some research to come up with the project alone and approved by his/her supervisor, or student and supervisor together come up with the project. Usually, it is required to be a working project. Means, it must be a real-world software product. To design and develop such a software product, a student applies what he/she has learned in his/her classes. This will be a good review for the student and sees the application of what has learned. In addition, the student may need to learn new things required for completing the project. In some cases, there is some cost involved because the student needs to purchase some materials. It will be very helpful if the department allocates some funds for this purpose. There is a possibility that the student finds a company who is interested in this finished product and provide some fund for this project. At the end, the student needs to write a detailed report including the documentation and manual for using this software product and do a presentation to a group of evaluators.

### **Field Trips**

Field trip can be a good experience for students. It provides students a real-world experience and helps students to understand the world. By going on field trip, students see the connection between what is happening in the classroom and the real world. They see that what they learn in classroom can help them solve the real-world problems and have direct impact on the community around them. This is a good opportunity for the students to see what they can become and initiate a connection with a key person of the company and the industry that they visit which may benefit them in the near future. This will help the students to build a confidence that they can play a positive role in the society. For more information refer to [2].

### **Internship**

Internships offer a crucial pathway to future employment for the next generation of nonprofit leaders [3]. An internship is a temporary work experience that allows students to get real world hands-on experience under the supervision of an experienced professional [4]. An internship should include learning goals that connect concepts learned in the classroom to real world scenarios in an effort to gain practical experience and help the intern accomplish their career goals. Another goal of internship is to provide opportunity for the students to learn some new things that they will not learn in their classrooms. Internships are important because they offer several benefits to both parties, students and employers. Students and employers get to know each other, and, in most cases, students end up getting hired by the same company. This is because the students get trained under the supervision of experienced professionals and do not need to go through training period anymore and this will save time and money for the hiring company. Some internships are paid while others are unpaid. If the internship is unpaid, the university may have scholarship funds to pay the student for his work. No matter what, the main focus of an internship should be on getting experience.

Many companies and organizations are willing to provide internship for the students. The question is how the students can find an internship. There are lots of different ways to find an internship. But they typically involve one thing: networking. The right internship is out there somewhere and sometimes finding it is just a matter of asking around. The university has internship coordinator who can help the students to find one. Here are some different ways to find an internship:

1. Consult with the university Internship Coordinator.
2. Asking faculty, advisors, friend, and family may be good option. It never hurts to ask.
3. Student can reach out to his/her Dream Company and ask for it.
4. Attending department advisory board and chatting with board members can be a good option too. Make sure to get names and contact information to follow up.

For students, internship has multiple benefits. They can get paid for their work, gain hands-on experience, secure their future career, and get academic credit. University and college curriculum include internship courses for students to take. Some programs require that students do internship. For some programs, internship is considered elective. To receive credit for internship students will need to take an online course in conjunction with their internship experience. To receive one hour credit, student may need to work 60 hours as intern. This is important when determining how many credits you'll be taking based on how many hours a week you can comfortably fit into your schedule and what your internship host is able to accommodate – something you should also establish with your internship host beforehand. Also, you need to work with your site supervisor to determine three to four objectives that go under the description area on the internship application for credit. The internship class instructor should approve this planning although this may vary from program to program.

Here are some quotes from student about their internship experiences:

“My experience here at Trove Brands for my internship has been amazing. I never thought that I could learn so much so quickly, but it has been an incredibly valuable, interesting, and informative experience. I've been able to learn so much about how companies work and how development teams are run”.

“Overall, this internship has been one of the greatest experiences for me. It has been a wonderful opportunity for me to be able to work closely with professionals who are extremely talented and do well at their job”.

“Over the course of my internship through this semester, I have learned a lot of invaluable new skills that will be very applicable to my future career”.

## **Conclusion**

Every year new technology is being imagined, built and launched. This development is taking place at such a high speed that is fueling a tremendous increase in demand for computer science professionals. As a result, the industries and organizations have many open positions that can't simply fill them. This is because the institutions of higher education are not graduating career-ready students fast enough to meet this high market demand. To prepare a well-rounded, industry and career-ready student, the above-mentioned activities are very crucial.

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