Q. How is your intro CS course different from other intro courses in the CS curriculum as it’s currently understood?

A. There are two main differences. First, our course is intended for all students—that’s why we title our book *Computer Science: An Interdisciplinary Approach*. We serve students interested in biology, chemistry, economics, English, history, psychology, and so forth, not just CS majors. We teach students that programming is a natural, satisfying, and creative experience, and that knowing about CS will be important for them in whatever field they choose.

Second, we teach fundamental ideas in computer science, not just programming. Computer science has a rich history and substantial intellectual underpinnings. It is a fascinating story that is not difficult to understand, but is often lost in intro courses that focus on programming. People who know that computer science is much more than programming have a much improved chance of succeeding when encountering computational challenges in the future.

—Robert Sedgewick
Q. How can studying CS benefit the non-CS major? What do you mean when you say “Computer Science For All”?

A. Whatever major they might choose, students nowadays know that CS is pervasive and that they need to learn as much as they can about it. Incidentally, our experience is that first-year students have little idea of what CS is about—one of our missions is to give every student the opportunity to make an educated choice of major.

Archeologists write programs to piece together fragments of ancient ruins, economists apply deep learning models to financial data, linguists write programs to study statistical properties of literary works, physicists study computational models of the universe to study its origins, musicians work with synthesized sound, biologists seek patterns in genomes, geologists study the evolution of landscapes, artists work with digital images, and the list goes on and on. Students who take our course learn that whatever you’re working on, the more you know about CS, the more successful you can be.

For many years, there has been broad consensus about the basic knowledge that every educated person should have—without question it is time to add computer science to that mix.

Q. You taught your own children at Princeton. Can you reflect on that experience as you developed the curriculum?

A. One of the catalysts that got me working hard on this course was when my oldest son, a Physics major, spent an afternoon in a science lab using a calculator to process results—something that could have been done in a fraction of the time with a simple computer program. I realized that people all around the university could be saving enormous amounts of time if they had some understanding of computer science. That was 25 years ago—now, you can see clear separation in all areas between younger people who are comfortable making effective use of the computer and older people who are not able to do so.

I certainly knew very little about what college students are like before my children got to college, and I certainly learned a lot about the student point of view when they were in college. One of the most important lessons for me was that we have to work with material that students find interesting. (It’s not enough for me to find something interesting.) That’s what led us to reach out to other areas of study. From the beginning, students from other departments have been working with us to turn their experiences in other courses into content for our CS courses. The first year, a physics student helped us develop a simulation of planetary motion that also illustrated a basic programming construct. Another time, a music student helped us develop an assignment based on synthesizing sound using a fundamental computer science concept. These are now classic assignments in our course.
Q. What obstacles did you face in making these changes to the curriculum?

A. Change is always difficult. To add a new course taken by three-quarters of all Princeton students is certainly a significant change. At the beginning, large numbers of students could not fit the course into their schedule, and people worried about what course they might have to drop in order to learn CS. Also, there were several intro programming courses taught in different departments around the university, and we had to convince other faculty to abandon those specialized courses so that their students could be prepared for further study in CS.

In 1992, I sought counsel from the professor teaching the large intro physics class, and I’ve never forgotten his advice: “If you create a good course, they will find a way to take it.” So the main obstacle has been to get the content right. I wish I had written this book 25 years ago, but it took 25 years to get the job done, with a great deal of help from Kevin.

Q. You have your lectures recorded as studio-produced videos which have replaced live lectures for two years now. How does this model accommodate learners of diverse backgrounds and different abilities?

A. Another way to think about this question is to turn it around. How does the standard large-live-lecture model accommodate learners of different styles and abilities? When you have hundreds of students in a room and lot of material to cover, there is little room for accommodation.

By contrast, the online-video model is ultimately accommodating. Students watch the lectures when and where they want, can control the speed, rewatch difficult sections, pause and study from the book, and so forth. In a large live lecture, most students are either lost or bored; with online lectures, most students are generally engaged with understanding the material.

And you would be surprised at the extent to which students feel a personal connection to me through the videos. By the way, there’s not much personal interaction in a large live lecture.

Q. You’re not suggesting that teachers become obsolete, but that their efforts be focused elsewhere, right?

A. It is important to remember that lectures are only one ingredient in a typical large intro course nowadays. Our faculty meet regularly with students in small groups and conduct office hours to help them succeed. With large live lectures, most of this interaction centered around reteaching the lecture material to students who got lost in the lecture (or missed it).

Now, our teachers spend their time with students on things like preparing them for success on exams, conducting problem-solving sessions, in-depth coverage of programming assignments, and other forms of enrichment.
Generally, since we have been using online videos instead of large live lectures, teacher-student interaction is at a much higher level than before. Students know the basics from the videos, so the discussion can be about applying and connecting concepts, or delving more deeply into some topic of interest.

And faculty at other institutions can adopt the same model. In the 20th century, we didn’t insist that every professor at every institution write a textbook for every course. In the 21st century, does it make sense for every professor to prepare and deliver lectures, when good online lectures are available?

The careful curation of Professor Sedgewick’s lectures made it easy for me to break into the world of Computer Science, where I had no previous experience. Because the instruction was pre-recorded, I had the flexibility to learn at my own pace and fit the lectures into my personal schedule.

—Rae Perez, Princeton University, Class of 2019

Q. Your Algorithms textbook has influenced a generation of programmers who are now building our computational infrastructure, from smart phones to social media apps. What is your ultimate vision for your new book Computer Science: An Interdisciplinary Approach?

A. For it to be a standard textbook used to teach computer science in schools and colleges around the country and around the world, and for it to be read by individuals of all ages interested in learning computer science. We achieved that goal with Algorithms, and believe that this book has even broader appeal.

Q. Don’t things change? How do you keep the content up to date?

A. If you look at standard textbooks in economics, calculus, physics, and many other fields, you won’t see much difference between the ones used today and the ones used 20-30 years ago. New editions typically cover the same fundamental ideas as the old ones, with improved exposition, better examples and exercises, and so forth. Computer Science is no exception: Algorithms, for example, is on its fourth edition.
Numerous books can be used to introduce students to the Java programming language, object-oriented programming, and basic data structures and algorithms. But few if any also introduce the reader to such a broad, beautiful tapestry of topics representing what we now call Computer Science as well as Robert Sedgewick and Kevin Wayne’s new book.

—John Spurgeon, Valley Catholic School
Q. Do you see a parallel between how the video lectures are offered to students and streaming services provide content to viewers?

A. Yes, there is an exact parallel. It used to be the case that consumers had to watch what TV networks wanted them to watch, when they wanted them to watch it, with ads, no ability to pause, skip, or rewind. Now, the consumer chooses what to watch and when and where to watch it, and the market and demand for it have literally exploded. The same potential exists for education. Doesn’t it seem as though doing the same thing for education would lead to an explosion of people educating themselves throughout their lifetimes, rather than for just a brief period when they are young? We are already beginning to see this happen.

Even more important is the issue of accessibility. Millions have watched TV almost since its inception, but educational institutions have been serving only a very narrow subset of the population—others have had to work around. With online lectures, anyone interested in learning the material can benefit from the very best lectures available.

At the outset, I thought of the online videos and the booksites as important enhancements to the textbook model of the 20th century that teachers around the world can make use of to accommodate the learners at their own institutions. Now, we’re seeing that large numbers of individuals are learning from the material, outside of any institution. The idea of access to education when and where you want it is an extremely powerful one. Who knows where it will lead?