

Stanford CS Commencement

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Greetings to our graduates, their families and guests, members of the faculty and a special welcome to Persis Drell, the dean of the School of Engineering. My name is Alex Aiken, and I am the chair of the Computer Science department. While I've been a professor at Stanford for over a decade, I'm relatively new to my role as department chair, and I must admit to you that this is my first commencement address. How bad can it be? You are about to find out.

I believe everyone here recognizes that we live in a time when computer science is influencing all aspects of life and fundamentally reshaping the world around us. For those of you who are about to leave Stanford to go out into that world, it is a moment of wonderful opportunity, but also, I think, some responsibility. To illustrate what I mean, I'd like to indulge in a little history, and how that history is connected to us today.

The California Gold Rush of 1849 and its aftermath was a unique period. Hundreds of thousands of people came to California in a very short span of time, to a vast land that was literally a wilderness almost everywhere outside of a few small settlements. Most of the people who came were from the United States, but there were also many people from Canada, Mexico, Central and South America, every country of Europe, and from across the Pacific: people from the Kingdom of Hawaii, from New Zealand and Australia, Japan, and, especially, from China. There were also Native Americans in the gold fields, and freed and escaped slaves.

Many came to California by boat. More came overland in horse and ox drawn wagons. A few walked. The whole world came to California, and when they arrived they found something almost none of them could have anticipated. They found themselves in the midst of a great social experiment, a place where a large number of ambitious, mostly young people with very little else in common suddenly had to live together with only each other for support. (Perhaps it was a bit like the freshman dorms!) In the very beginning there were few of the formal mechanisms of society; there was essentially no government, in fact no

enforced rules of any kind, except those that the newcomers made among themselves. Some were quite conscious that they were witnessing the birth of a new society, one that came to value optimism and trust, ideas for bettering their lives and the lives of others, and the energy to put those ideas into practice. Especially distinctive, and many writers of the time comment on this, was the sense of opportunity: that with a good idea, hard work and a little luck, success was not only possible, but even probable. They heard and repeated the stories from the gold fields, they saw it in the ventures of their friends and neighbors. There was excitement about the future and people eagerly anticipated the progress that came almost day by day.

The people came to California for many reasons. Some came to be part of the great experiment, some came to get a fresh start, and some came simply out of a sense of adventure. Many fell in love with the climate, the endless days of mild weather and perfect blue skies. There were many discoveries: trees larger than anyone had ever seen before, new kinds of animals and plants, the highest mountains, the biggest volcanoes, the hottest deserts.

And of course many came for the gold, more gold than the world had ever seen before. At first, gold could be found just lying on the ground, but technology quickly became necessary. Picks, shovels and gold panning gave way to sluices of increasing sophistication, and eventually to a breakthrough, hydraulic mining, which spread around the globe after its invention in California.

As the population grew and became more organized, the people of California took on ever more ambitious tasks, culminating in one of the greatest and most difficult engineering achievements of the 19th century, the construction of the California portion of the transcontinental railroad across the Sierra Nevada. For reasons that will become clear shortly, I'd like to tell this story in a bit more detail.

There were five men, all Californians, who were primarily responsible for the railroad being built. The first was an engineer, Theodore Judah, known as "Crazy Judah" because he spent most of the 1850's telling anyone who would listen that it was possible to build a railroad over the incredibly rugged Sierra Nevada. He spent many months walking in the

mountains, scouting for a feasible route. He eventually convinced four Sacramento businessmen that he had found the way, and together they lobbied and convinced the US Government to back the project. The five of them risked everything they had. The company they formed to build the western portion of the railroad went to the brink of failure multiple times because of a series of formidable technical, financial and political challenges. In the end, the Central Pacific Railroad became a wildly successful business, one of the most successful ventures of the age. The railroad and the accompanying telegraph revolutionized travel and communication, cutting journeys that would have taken months to days, and allowing messages to be sent in seconds. In short, the Central Pacific Railroad was a classic California startup.

There are other strong parallels between the period of the California Gold Rush and the situation today, and to your situation as you prepare to leave Stanford. Today's gold rush is the information technology revolution, a change so sweeping that it is becoming a central part of day to day life for every human being on the planet. The world is still coming to California to be a part of that revolution, and the sense of opportunity is again immediate and palpable. Advances in computation are enabling tremendous progress across all of science and engineering, and there is not just a hope but an expectation that there are many more discoveries to be made, marvels that no one has seen before or even imagined. Excitement is in the air.

And there is no doubt that we are in the midst of a great, world-wide social experiment. Rapid advances in technology are not only giving all of us new capabilities that improve our lives, but they are also reshaping the basic social relationships among people, and between people and institutions. Much of this terrain is uncharted, a wilderness where we have all suddenly found ourselves together with little experience to guide us. The ease with which information can be collected and analyzed is eroding the traditional boundaries of anonymity and privacy. At the same time, it is harder to know if the person you are talking to via chat or email is actually who they say they are. Every organization, whether a company, university, or national government, is under significant stress, experimenting with how it can and should act in a world where the ability to record, collect and analyze every and any kind of data has far outstripped our shared understanding of what we

can do and what we should do. So far, only 40% of the world's population has arrived in this new on-line place, but it's a safe bet that the other 60% are on their way.

So, what lessons can we draw from the time of the California Gold Rush, lessons that might be useful or interesting to a Stanford CS student graduating into the information revolution of 2015? I think there are four.

First, timing matters. If you came to California in 1849, you had a very different experience than if you came in 1850 or 1851. All were part of an exciting time, but there was something special about being a '49er. I congratulate you on your timing. There has never been a better time to be starting out as a computer scientist than today.

Second, keep your eyes open. When new frontiers open up and the first pioneers arrive, opportunity may simply be lying on the ground, waiting for the first person who notices to pick it up. Other times you may have to dig a little to reach those opportunities, and at other times you may need to invent something new.

Third, be mindful of what you do. It sounds a bit dramatic, but I believe there is a new kind of society being created, a global society that inhabits the on-line world where we will spend an increasing portion of our lives. Like California in the 1850's, what kind of society it will be is very much up for grabs, and there are no guarantees that we will be happy with the results. While the Gold Rush is generally remembered as a time of positive progress, many of the historical details are much less encouraging. Bad things did happen, as well as some terrible things. It was only because of the efforts of many individuals to push society in the positive directions that things turned out as well as they did. How we will live together in the on-line world is still a work in progress, with implications for what life will be like for everyone in the rest of the 21st century. The people who understand the capabilities and especially the limitations of our technology have a special responsibility. At least some of you, and probably quite a few, will at some point be faced with decisions that will affect how millions or perhaps billions of people live and work, and the decisions that you make will set the tone for all who come after, for better or worse. Be mindful of what you do.

Before I get to number four, I want to mention a postscript to the story of the building of the transcontinental railroad. Together with his wife, one of the founders of the Central Pacific Railroad decided to use his fortune to found a university in California. Jane and Leland Stanford gave the endowment and the land to create Stanford University. But beyond that, they, and all the people who joined them to help build the university, established a culture, a culture that valued optimism and trust, ideas to make the world a better place, and the energy to put those ideas into practice. People often ask why Silicon Valley happened here and how Stanford came to have its distinctive personality, and by this point you probably know my answer. There is not just a parallel with the crazy years of the 1850's; it is not an accident that the values of the university so strongly resemble the values of California's pioneers. It is the same attitude, the same sense of optimism and possibility, and the same desire to make a difference that was built in to the university at its founding by the people who lived through those formative years. That culture was nurtured over generations and transplanted to Silicon Valley and beyond, and is now helping to drive a global technological revolution.

So, number four is: give something back. The Stanfords and all the other people who contributed to the founding of the university would be astounded to see the results of what they created. We can all be thankful that they did.

In summary: Timing is important. Keep your eyes open. Be mindful of what you do. Give something back.

Our graduates today have come to Stanford from all over the United States, and from all over the world. I want to thank your families for their support. Congratulations to the graduates and thank you for your contributions to the Stanford community. And good luck! Come back and visit us; more likely than not, the weather will be mild and the sky will be a perfect blue. Thank you for your attention.