CRA Workshops on Academic Careers for Women in Computer Science and Engineering

"Getting a Job"

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Panel participants:

- Francine Berman, University of California at San Diego
- Eileen Kraemer, University of Georgia
- Jill Mesirov, Whitehead Institute
- Toni Pitassi, University of Pittsburgh
- Barbara Ryder, Rutgers University
- Valerie Taylor, Northwestern University
- Jennifer Schopf, Northwestern University
- Faith Fich, University of Toronto

1. RESEARCH OPTIONS AFTER GRAD SCHOOL

This chapter is a compendium of several excellent CRA-W panels on “Getting a Job”. The panels were generally composed of senior researchers who had considerable experience with interviewing candidates for a job, and new faculty who had recently been successful on the job market. The panels focused primarily on academic jobs, touching on postdocs and industrial jobs as well. The following sections provide a comprehensive discussion on the process of getting a job based on the information offered in the panels as well as my own experience on both sides of the job market.

2. POSTDOCS

A postdoctoral fellowship (postdoc) gives you an opportunity to "upgrade"—to work at a more prestigious university than the one you graduated from, or work with a well-known person in your area. Alternatively, you may also take a postdoc to work in a related or different area without the responsibilities and pressures of a faculty position. If you can secure a postdoc at a prestigious school or with a famous advisor, you have instant leverage the next time you go out on the job market. Moreover, you have time to generate additional publications for your vita and perhaps write some grants to fund your professional activities.

Start looking for a postdoc the year *before* graduation. Typically the funding cycle is to secure a commitment sometime in the Fall or Winter with your prospective postdoc advisor. The advisor will need to find funding for you or perhaps apply for additional funding. Alternatively, you can apply to NSF or other agencies for a postdoctoral fellowship. This enables you to bring funding with you to the institution of your choice. Finally, researchers will advertise for postdocs through their professional contacts or through mailing lists such as Systers. Such advertisements may come at any time, and not just in the Fall. The typical time period for a postdoc is 2 years with 1 year postdocs and 3 year postdocs also possible.

However you are funded for a postdoc, think carefully about who you will postdoc with and what institution they are associated with. Talk with your prospective new advisor and perhaps their grad students and/or other postdocs and *be clear about their expectations* – some advisors will consider you a "free agent" while others will expect you to work on specific projects. Knowing up front what to expect will help you get the most out of the experience.

3. PURSUING A CAREER IN ACADEMIA

For PhDs interested in research, academia affords attractive benefits: flexibility in schedule and workload, autonomy in what and how you research, opportunities to work with students, and continuously challenging work. Note that professors at research colleges and universities are typically required to do much more than research: they teach courses, mentor graduate and undergraduate students, serve on departmental, university, and national committees, write grants and research publications, etc. The more senior you become, the more you are likely to participate in advisory committees and national service as well. This in turn impacts your research career--it keeps you busy, provides a connection with a wider professional community, and gives you an opportunity to impact science on a larger scale. In addition, many professors also consult with industry.

This section and the next give detailed information about applying for a faculty position at a college or university in which research is a substantive part of your job. In Section 5, we briefly describe how industrial research positions differ and discuss the process of applying for a research position in industry.

3.1 YOUR VITA

Your Curriculum Vitae (a.k.a. *C.V.* or *vita*) is your academic résumé. It should be written in an academic style if you are applying for a faculty position or postdoc at an academic institution.

What is considered "good" on a vita will vary from institution to institution and from person to person, but it is important to consider what recruitment committees (or potential

advisors) think is important when developing your vita. Graduate students have a tendency to think "Having a great thesis is what's really important." A good thesis is definitely a critical element of your vita, but it is not the only one. In evaluating your vita, recruitment committees will look at the following factors:

- What school you come from
- Your research area
- How famous your thesis advisor is
- How good your thesis is
- The number and quality of your publications
- Your letters of recommendation
- Any special awards, fellowships, professional service
- (Are you a target of opportunity?)

Spend time developing a good vita from your first years in graduate school. Apply for special fellowships and awards, impress your advisor, publish your results and give talks at conferences. Nurture a set of letter writers who will be credible to your recruitment committees and who will have strong positive things to say about you. (Note that some institutions may value letters from academics more than letters from industry unless the letter writer is world famous.) Make sure your thesis is both strong scientifically and communicates your problem and solution in a clear, compelling manner.

When you are ready to go out on the job market, you want your vita and application letter to reflect your hard work. Identify what aspect of computer science you specialize in at the beginning of both your letter and your vita. Make sure your vita is clear, easy to read, and has no spelling errors. Check with new faculty in your department and/or successful grad students for examples of a good vita and model yours after it. Note that although there are many, many interesting things about you, only the professionally oriented things should go on your vita. In most cases, it is appropriate to exclude hobbies, marital status, outside activities, etc. from your CV.

In the following subsections, we expand a bit on the factors of importance to recruitment committees.

3.1.1 SCHOOL AND ADVISOR

All other things being equal, coming from a top school with a well-known advisor who supports you can definitely give you an edge. People will be impressed to find out that you are from a top 10-ranked institution and that Professor X is your advisor. There are trade-offs, however. Professor X may compare you to his/her other students--a fairly competitive group. Having Professor X will make you stand out but a mediocre reference letter will make you a less desirable candidate.

If you’re reading this pre-grad school, go to the best known graduate school among the graduate schools that satisfy all your other criteria. This will improve your chances on the job market when you graduate. When picking an advisor, choose someone who is

respected in the area in which you feel the most creative and interested. Look for an advisor who is well known, matches your professional style, and has a good track record with students. Try hard to impress that advisor. Your goal is to do a strong thesis and get a strong letter of recommendation--essential factors in getting a job.

3.1.2 RESEARCH PRODUCTIVITY

Recruitment committees are very interested in your research productivity. Conference and journal publications indicate that your professional community is impressed with the quality of your results. *Do not wait until you are done with your thesis to begin writing papers.* Publish your work along the way as it matures and build a professional community. (Note that technical reports are not considered publications by most universities.) Give talks at conferences and network with other people in your field. Getting a job is often the result of personal contacts made in an informal setting when you can share your research ideas in more depth. The frequency of publications, number of publications, and the conferences you publish in are area-dependent so you should be talking with your advisor and other people in your area about a good strategy. In some areas, graduate students publish a half-dozen papers or more in order to be competitive.

Your vita should include refereed publications (conference and journal), any book chapters, technical reports, and submitted publications. It should also include references to any invited talks, or workshop presentations you have given.

3.1.3 AWARDS, FELLOWSHIPS

Awards, special fellowships, and internships will help distinguish your vita from those of other applicants. They indicate to recruitment committees that you are already accomplished. You can apply to many of these programs in your first year of graduate school (e.g. the NSF Fellowships). You should also look carefully at fellowships sponsored by industry (e.g., AT&T, IBM) as well as government organizations (NASA, etc.). Not only do these fellowships provide you with independent funding throughout your graduate career, but often they provide you with opportunities to widen your network and to establish ties with potential future employers.

Many of these fellowships are competitive. Talk to your advisor and others in your department to determine which fellowships you might apply or be nominated for and what your best strategy is. You may apply for some fellowships multiple years.

3.1.4 TARGET OF OPPORTUNITY

Although in many places affirmative action is now against the law, there are schools that endeavor to improve the diversity of their faculty by putting aside special funds to attract qualified members of underrepresented groups. In such cases, it is helpful to be a "target

of opportunity," i.e., a member of an underrepresented group that the university is trying to hire. Typically, the criteria applied to hiring underrepresented minorities is the same as it is for everyone else. The difference is that the position may be supported by special funds put aside for this purpose. In this case, being a qualified applicant from an under-represented group may help you get a job. However, there are also occasions when qualified representatives from underrepresented minorities suffer because of their group association--as most of us know.

3.1.5 LETTERS OF RECOMMENDATION

Many places have a two-phase process where the department receives applications and solicits letters of recommendation from the candidates that they are interested in. Other places ask candidates to send recommendation letters along with their application. Typically, for a junior position (Assistant Professor), 3-5 letters are requested. Postdocs may be asked for 0-3 letters, depending on the situation.

It is critical that your letters be strong, positive letters. The letters should show you at your best and indicate your technical strength and suitability for the position. Your letter writers may compare you to other students at your institution, other students they have had, and/or other people in your area at your level. One way to try to determine if your letter writers will be supportive is to ask them if they would feel comfortable writing a *strong* letter (rather than just a letter) on your behalf. It is far better to know that a prospective writer is uncomfortable writing a strong letter than to have a weak letter go out to the places you are applying to.

Your advisor or another trusted faculty member can help you determine a set of letter writers who will write the strongest letters on your behalf. You may even have them ask for you. Letters can come from anyone who is well respected by the research community. They need not be confined to professors at your university. The best letters are strong letters from the most famous people in your research community (academic or non-academic). Next best are typically academic letters. Another source of letters--although not as highly regarded as the latter two--is industry people not well known in the research community. Note that if your job search goes poorly, you may want to reconsider who your letter writers are for the next time around.

Once you have determined your set of letter writers, send them your CV and other supplementary material to assist them. Even if they know your work well, they may not be aware that you were awarded a fellowship or that you won a “Best Paper” award at an important technical conference in your area. Access to specific information helps your letter writers write the strongest possible letters.

3.2 THE JOB APPLICATION

The job application consists of a cover letter, a vita, a brief (1-3 page) research summary, and possibly a teaching statement. The cover letter should state clearly what job you are applying for, what your area is, your advisor and institution, and indicate the area of your research. Your vita should include the elements discussed in the previous subsections. The research summary is a 1-3 page description of the work you have done, what you have accomplished, and how you view your research. This summary gives people a feel for the kind of problems you like to work on, and what you are good at. Note that your research summary will be read potentially by all faculty--not just those who are in your field of expertise.

The teaching statement should be one page. In that statement, you should discuss your experience, what kind of courses you can teach and have taught, innovative ideas that you've had that you've used in the courses that you've taught, and perhaps your teaching philosophy. If you haven't taught and you've only TA'd, you may still choose to include a teaching statement which talks about your experience as a TA.

It is very important that all these materials be well-written, clear, and concise. Get help doing this and look at other people's materials when you formulate yours. Make sure everything reflects the style (academic or industrial) of the place you are applying to. Use a spell checker.

3.3 DECIDING WHERE TO APPLY

Academic positions and postdocs are often advertised in journals such as IEEE Computer and CACM and on the web. You may also apply to institutions that are not currently advertising positions. Send your vita with your cover letter and your research summary to the prospective institution. You may want to keep a file on where you sent applications, when you sent them, and notes on follow-up.

Apply to any place you would consider going. There are many reasons to apply for a job at a particular institution – professional considerations, geographical considerations, quality of life considerations, family considerations, etc. All of them are good reasons to apply. Apply to institutions both “up” and “down” the rankings from where you think you are best matched. Apply to institutions where you think there is something interesting going on in your research area. Sending an application is nearly free and implies no commitment on anyone’s part. If there’s any chance that you may be interested in an institution, apply. *Be open-minded*. You may find that you are a good fit with a department you had never thought you would like, and not be as good a fit with a department you assumed would be a good place for you so apply broadly.

Note that each institution will have expectations for their faculty. For some institutions, it is assumed that faculty will be heavily involved in research and will become national leaders in their research areas. At other institutions, it is assumed that faculty will spend a considerable amount of teaching and interacting with undergraduate students. Be aware of the expectations of different institutions to which you apply. This will help you focus

your applications. In fact, you may want to have slightly different versions of your application packet emphasizing different things about you depending on the focus of the department.

3.4 THE SELECTION PROCESS

When a university receives your letter, they will add it to a growing pile of applications. The recruiting committee, recruiting chair, department chair, and/or other faculty will look at the letters that have been received. Letters of reference will be requested for some of these applications. A small set of candidates will be asked to come for an interview based on these letters. At this point, your goal is to be asked to come for an interview. Therefore it is important to be in the set of applicants for which letters are requested, and for those letters to be positive.

The more you have strengthened your vita, the better position you will be in to get the attention of the recruitment committee. From the university's perspective, nothing will happen for candidates for whom letters have not been requested, so you definitely don't want to be in this group. Sometimes, you can encourage the process by getting in touch with someone on the faculty of the institution you have applied to (or having your advisor or another faculty member get in touch with them) and inquiring as to the status of your application. This may prod the process if the person who has been contacted can encourage the department to request letters for you or request letters on the department's behalf. This is where your good work at networking and your visibility from presenting papers at conferences pays off.

After your letters have been received at an institution, there will be a lot of discussion. At this point the department must decide which of the qualified candidates will be asked to interview. Typically the department will ask for letters on many candidates but only interview a handful of them. Who the department ultimately chooses to interview is a function of who applies, departmental needs, opinions of the department's faculty members and research groups, politics, and a variety of other things. It may be helpful to have a local faculty champion at an institution at this point. It helps to have impressed the people in your area by your vita or perhaps in person when you have met them at a conference, but there's not much you can actively do at this point.

3.5 THE INTERVIEW

The interview is a major step. Once an institution asks you to come interview, you have a real chance at the position. If you are asked to interview, the ball is now in your court. The best thing you can do is to be really prepared and try to relax. Before you get to the interview, check out the institution on the web, get some sense of the kind of research that is done there and what the strengths of the department are. *Prepare a really polished interview talk* (more on this later). Talk to your advisor and other faculty members and get a sense of the department. Ask the department for some literature on the institution

and look at it. Knowledge is power, and the more you know before you get there, the more prepared you will be at the interview, and the better able you will be to ask and answer the right questions.

The typical interview day is long, exhausting, and fun. Get a good night's sleep and be prepared for a lot of meetings. Generally you will start off the day with breakfast with your host. After that, you will have meetings with faculty members, undergraduate and/or graduate students, staff, and possibly the Dean. These meetings will typically last between thirty and sixty minutes. Note that you may request to see specific people or groups during your interview. You may want to talk with graduate students, systems staff, and particular faculty members. These people can give you different perspectives and can help you get the "feel" of a place.

A very important part of the day will be your talk—which may or may not be attended by the people you would like most to be there. Typically, you will be meeting people and "on" from breakfast through dinner. It's tiring but it can be exhilarating as well. You want to get through the day relaxed and at the top of your form. You really have several goals here. You would like the department to be interested in offering you a job, and you want to get a clear enough impression of the department to determine whether you would like working there. Here are some tips that will help.

3.5.1 THE TALK

At many places, the talk will be the single most important part of your interview. You are communicating many things during your talk: that your research is addressing an important problem with an innovative solution, that you can communicate well, that you would be a good addition to the research and instructional climate of the department, that you are a person who would fit in well with the style of the department. Your talk should be rehearsed and polished. Develop your talk with your advisor and research group. *Give your talk in front of (possibly different) audiences at least twice (and probably more) before you give it during an interview*. The talk should be clear and in the genre of your research area (hand-written slides, Powerpoint, videos, whatever people in your research area typically do). Note that if you use something other than overhead slides, inform your hosts in advance so that they will have the proper equipment and make sure that you have a backup. If your talk is the time the department discovers that the LCD projector is not working and you have no backup slides, it can really throw off the interview.

The talk itself should convince your audience that you have tackled an important problem and devised an innovative solution. You really are targeting two audiences here: first you want everyone to understand what the problem is that you are addressing and that your solution is important, and second, you want the specialists in your research area to be impressed. Make your problem and solution generally interesting to people not in your area, and provide a good overview of the solution. You must also provide enough detail to convince specialists in or close to your area that your approach is innovative, credible

scientifically, and a research contribution. Appealing to both specialists and non-specialists in the same talk takes practice.

3.5.2 INTERVIEWS WITH FACULTY

During your visit you will interview with a number of faculty in the department. During these interviews, you want to make a good impression and get a good feel for the people in the department, its political and social structure, and the interests of the faculty. Be prepared to have a one minute, 5 minute, and 15 minute description of your research. Have a future direction for your research. Faculty will want to know not only what you've done but what you plan to work on in the future.

Have some questions in mind based on your web research on the faculty and their interests as well as other things you want to know (What is the teaching load? How are the students? Do faculty members usually work on joint projects or independently? etc.) Ask several people the important questions; you'll get a much better feel for what's really going on. Also, don't forget to ask faculty about their research – you should know what interests your potential future colleagues most, and most faculty will appreciate the opportunity to talk about their work.

3.5.3 INTERVIEW WITH THE CHAIR

During your interview with the chair, you want to get a feel for the vision of the department. You may also touch on more practical details--rank, salary, startup package, etc. Be prepared with some idea of what you'd like--teaching preferences, equipment, initial course reduction or committee reduction, RA money, summer support while you are writing your first grants, etc. Note that in many places the startup package comes from the institution rather than the department; it is in both your and the department's best interests for you to start well endowed.

3.5.4 INTERVIEW WITH THE DEAN

At many places, you may meet with the Dean--who may have more or less influence over the department's decision to hire you. You might want to ask the Dean what his/her vision for the department is--how much he/she sees it growing, in what areas, etc. The Dean may also control your startup package so impressing him/her that you need resources may not be a bad idea.

3.5.5 INTERVIEW WITH STUDENTS

The students will tell you what's really going on: how the department works, who holds the power, etc. You can also get a good sense of what caliber the students are as you will

probably be meeting with the best students in the department, and/or students in your area. Asking them how they choose an advisor will give you insight into how competitive it may be to attract strong graduate and/or undergraduate students to work with you on your research.

3.5.6 INTERVIEWING THE DEPARTMENT

Don't forget that you are interviewing the department while they are interviewing you. Ask hard questions and listen to the answers. Try to pick up some information about the social and political structure. What is the situation for tenure? In some schools, junior people are hired with the intention that if they perform well, they will be able to get tenure. In some schools, tenure may be awarded to only a fraction of the junior people that perform well, or as the result of an "open" search in which junior people compete with candidates from outside the institution. How much power do the chair and the senior faculty have? Do you feel that you would be happy working in this environment? Try to get as much information as you can while you interview. It is often useful to write yourself some notes when you get back to your hotel room. These notes can be invaluable after multiple interviews when you are trying to remember specifics about a particular institution.

Look interested in the job or at least look as though you would seriously consider the job. You won't really know if this is the best place you've interviewed until after you've gone, so maximizing your chances of getting a job at this particular institution is a reasonable thing to do. In addition, if university A offers you a job, you can let university B know your deadline and perhaps hasten the process at university B. Having a job offer can provide leverage for additional offers at places more desirable to you, and multiple offers can help you improve your offer from the place you'd like to work.

3.5.7 SOCIAL EVENTS/MEALS

Don't forget that you are still interviewing during meals. Even though it is a more relaxed and informal social situation, everything will count towards the final decision. Avoid anything that won't work in an interview or a professional situation: telling off-color stories, getting drunk, etc.

3.5.8 SPECIAL INTERVIEW ISSUES

For each person, there are real-life issues which are important in the decision making process. For many people, these include the impact of the move on a partner or on children. We briefly discuss these below.

3.5.8.1 THE "TWO BODY" PROBLEM

If you and your partner are both looking for jobs and it affects whether you would be interested in a job from the institution at which you are interviewing, you may want to share this with the department at some point. Some people share this in the initial letter

and some don't share this information until after they have received an offer. The decision of when to share this information varies widely from place to place and from person to person. Some candidates mention their "two body problem" when things look like they are going well during the interview. The department or institution may be able to help connect your partner with relevant people in their area. If your partner needs an academic job, the department may only have limited influence, however.

There are also creative ways for you and your partner to deal with the two-body problem. You may decide to focus the job search on cities in which there are a number of institutions and companies (San Francisco Bay Area, Chicago, New York, etc.). Some couples have approached departments about sharing a single position. Some couples find good jobs in geographically distinct locations and "commute". Although institutions are becoming more sensitive to the difficulties of working partners, solving the two body problem still requires considerable flexibility and presents a real challenge to many couples.

3.5.8.2 CHILDREN, REAL LIFE ISSUES

If you want information on childcare or schools, you may want to ask about this during the interview. Ask someone who seems sympathetic to these issues, and ask them after you have established an impression of yourself as a researcher, which is what they are interviewing you for. This is true in general for other real-life issues as well during the interview. Although there is a lot more to you than your research interests, and indeed you will most likely make your decision about where to go based on a whole spectrum of things, the department is hiring you in a professional capacity and needs to have an impression of you in that context first. Note that departments often allow a second visit (sometimes called the "househunting visit") after they have made an offer. This is a great time to check out some of the real-life concerns that are important to you.

Finally, it is illegal for the department to ask you about your marital status or whether you have children, but it may come up in conversation anyway at a meal or by someone who isn't clear about the law. If you don't want to discuss these issues, you may want to plan ahead what you might say so that you can gracefully deal with this.

3.5.9 DRESS FOR SUCCESS

Times have changed since the book "Dress for Success" came out and researchers as a group tolerate a pretty wide variation in appearance. Basically, you want your prospective colleagues to remember your technical abilities and not your clothes. Wear what you are comfortable and confident in to the interview and try to stay reasonably within the mainstream. Most female interviewees wear some kind of suit (skirt or pants). Very heavy makeup, very short skirts, very high heels and formal attire are generally considered unusual. Most male interviewees wear pants and a sports jacket or a suit with or without a tie. In either case, the goal is to look professional and to feel confident,

rather than to wear any particular kind of clothing. You'll probably be walking and may be outside part of the time so make sure your shoes are comfortable and your "look" can survive a long day.

3.6 POST INTERVIEW

It is good manners to thank your host and anyone else who has spent time or effort on your visit. Departments generally try to be on their best behavior during interviews and will have spent considerable time and effort meeting with you and arranging your visit. Thanks to faculty, staff, and hosts is generally much appreciated. An email to your host, the department chair, the secretary who arranged things for you, and anyone else who spent time or effort on your interview or whom you particularly connected with is considered appropriate.

After the interview, don't spend too much time worrying about whether you will get an offer. The department's final selection process is often highly volatile. At some point in the department's interview process (usually after everyone has been interviewed but sometimes before), there will be discussions on who will get an offer. The quality of your interview is just one factor in how this goes. There may also be political issues: whose "turn" is it to add to their research area, what areas the Dean or the department wants to hire in, which candidates appeared more desirable to a greater cross section of research groups, who the department thinks they can get, whether political conditions have changed so that the faculty position you interviewed for is no longer available, whether it makes more sense for the department not to hire any of the candidates who have interviewed and to wait until next year and do the search again, etc. You will probably not know what's going on at this point, although you may want to stay in contact with your host or the department chair to get a sense of when you might know, and you certainly will want to let the department know if you have received an offer from another institution or have other hard constraints.

3.7 THE OFFER

With any luck at all, after this "black box" process has gone on, you will receive an offer. Once you receive an offer from the place where you want to work, you will have to negotiate the terms of your job. What you can negotiate for depends on the institution and the department. You may be able to negotiate for:

- salary
- rank
- start date
- summer salary
- equipment
- RAs
- travel allowance

- startup money
- “signing bonus”
- lab space
- home loan assistance
- house-hunting trip
- moving expenses
- course reduction
- committee reduction, etc.

Note that at some institutions, you may negotiate to come in at a higher salary or at a higher rank (which often implies a higher salary). As a rule, you want to get the best salary offer you can, and at the least what other people with your qualifications would get. When negotiating for rank, consider the time to tenure. Being brought in at a higher rank may force you to come up for tenure sooner, so make sure that the time frame associated with your rank works for you.

In conjunction with negotiating your salary, ask for at least the first year's summer salary. When you first get to your institution, you will probably not have a grant -- the usual source of summer salary. If you write a grant your first year, you still may miss the first year's summer salary depending on when the grant starts being funded and whether you get it. Negotiating for summer salary for the first year or so can help give you a good start on your research career.

In addition, grants usually provide for travel -- which will be critical for you in building your research community and eventually your tenure case. (You'll start building your tenure case as an Assistant Professor from the first, just as you started building your vita from your first years as a grad student.) Since you probably won't have a grant the first year or so, you should also negotiate for a travel allowance so you can go to professional meetings in your area.

For your first year it is a good idea to negotiate your workload so that you are not overwhelmed at the beginning. Negotiate a reduction in teaching load and committee work. If you can negotiate for RA support, do so; this will help you attract graduate students and get your research started. (Note that TA support is not as helpful for you since TAs are required to target their activities to the course they are supporting rather than to research.)

Ask for the equipment configuration that will allow for your best working environment. (Of course, you are much more likely to get a good workstation setup than a supercomputer!) If there's certain hardware or software you need for your research, ask for it. Think about both your work and home offices. You should also discuss laboratory and desk space. You will get an office, but where will your students sit? The department may organize itself so that each research area or particular research projects have a lab. At many places, your future colleagues can be helpful in determining your offer package.

Often the department is willing to help you with moving expenses and/or home loan assistance. Note that at many schools, the funding for new faculty and existing faculty come out of separate "pots." By getting a better package, you are probably not taking resources away from your future colleagues. Once you are there, limited or few institutional resources may be available to you. You will compete with other researchers for money from funding agencies to support your research, and you may compete with your new colleagues for space, students, discretionary funds, etc. Now is the best time to think hard about what you need to work well and to ask for it.

Finally, *it is not rude to negotiate your offer.* At most places, you are expected to do this. If you ask for additional resources, they will not revoke the job offer. At some point, the department will have offered what it can and you must decide if you are happy with it. At this point, it's up to you.

4. DO'S AND DON'TS WHEN SEARCHING FOR A JOB

The following is a compilation of advice from the CRA-W mentoring workshop panels on "Getting a Job":

4.1 DO'S

1. *Volunteer to be the graduate student representative on the recruiting committee at your institution*. This is an invaluable opportunity to learn how the recruiting process works from the inside. You will probably find the discussion once the applicants leave to be surprising.

2. *Attend recruiting talks* and get a sense of what works well and poorly with an audience. Note how different applicants deal with questions.

3. *Follow the academic year*. Apply for academic jobs November - January. Interviews will be held from January on, with most falling in February and March. You should receive your offers for most places March - June.

4. *Include copies of a couple of your best papers with your application*. Make sure that your web site is up-to-date.

5. *Show your application packet to your advisor and other faculty before you send it*. If your department has just hired someone or if another grad student has just gotten a job, ask to take a look at their packets and consider modeling yours after theirs.

6. *Keep track of and follow-up on your applications*. Record when and where you sent out your packets. Hold on to letters confirming the receipt of your packets. If you do not hear from a school, call them and ask about your application. Make sure that your applications did indeed get sent out. Keep track of any notifications

you get about problems concerning your packet. If a school requests letters of recommendation, mark it down in your records. Record all exchanges with the school—phone conversations, e-mail inquiries, faxes. You will minimize any erroneous delays in the processing of your application if you are organized. If the school sends you notification that they have not received your letters of recommendation, remind your letter writers or their secretaries about it. *Don't alienate secretaries*. They can definitely help smooth the process.

7. *Use any available resources for your job search*. There are several comprehensive web sites that are loaded with job openings that universities post. They are organized in different ways: how many available positions, school rank, location. Use a search engine to find "computer science faculty positions." Or look at the web pages of computer research organizations like ACM, IEEE, and CRA. Word of mouth is also a good way to get information about job openings.

8. *Leverage relationships with faculty in the department to which you are applying*. Well-placed questions can often provide you with good information and sometimes prod the process a bit.

9. *Apply to lots of schools*. Apply for positions that you consider up in rankings from where you belong and down in rankings from where you belong. An initial interview at a school where you do not really think you will go will help immensely as a practice interview. Also, you might be surprised to find some schools you visit are more appealing than you would have thought. Postage is relatively cheap, and you might get an interview or an offer at a school you never dreamed you could go to.

10. *Dress appropriately for your interview*. People should remember what you had to say and not what you wore.

11. *Think through beforehand how you will describe your research.* You should know the answers to the following questions:
    - Can you describe your research?
    - What is the most important contribution of your research?
    - What will you work on next?
    - Where do you see research in your field going in the next 5 or 10 years?
    - How does your research fit within this department?
    - What courses would you like to teach?

12. *Focus your talk.* Give a clear problem statement and the motivations for your work. Talk about related work and discuss future directions. Conclude with a strong summary review of what you've done on one slide so that people who leave the talk can come away with a good idea of what you do.

13. *Adjust your talk to your audience.* Tailor your talk to the institution you will be interviewing at. You may want to have a version of your talk that works better at a

more teaching-oriented institution and a version of your talk that works well at a more research-oriented institution. If you're interviewing at an undergraduate school or a school where undergraduate teaching is of primary importance, you may be asked to prepare an undergraduate lecture rather than a research talk.

14. *Polish your talk*. Practice your talk until it's the very best talk you can give. Any materials you have should be of high quality. Any videos you use should appear professional.

15. *Be flexible*. You will be given a schedule but additional people may want to talk with you or people may not be able to make appointments. 30 minute appointments often go longer and the schedule gets shifted. The department will worry about who you see when, but you will need to adapt to your evolving schedule throughout the day.

16. *Network*. View the whole process as an opportunity to meet people and to show off your work. Every person you talk to and every institution you visit becomes a part of your professional network. Even if you don't end up going there or even getting an offer, you will find your interactions with the people you meet while interviewing to be invaluable in your research career.

17. *Use good judgment in discussions with future colleagues*. You may want to avoid politically or socially charged discussions during the interview. Your job is to develop potential allies, rather than potential detractors.

18. *Take care of your health*. Being on the road can be stressful. Eat well, try to take a run or a swim or use the health club if you can. You'll interview better if you feel good while you're traveling.

19. *Accept the job you want*. Consider everything -- how you fit in, whether you want to live in that city, what your quality of life will be like. Go to the place that feels the best to you.

4.2 DON'TS

1. *Don't refrain from contacting a school just because it is not advertising.* Advertising deadlines and institutional deadlines are not always in sync.

2. *Don't be afraid to contact schools that you have yet to hear from.* Once you get some offers you might run into a problem with deadlines. One school might give you a deadline by which to respond. But you might not have yet heard from the school you prefer. Don't let it slide. Call the department chair of the school you prefer and say, "Hello, Dr. X. I interviewed at your university in February and I have received some offers from other schools with deadlines within the next two weeks. I wanted to let you know that I am still interested in your university. Do

you know when you will be making a decision?" This should generate some kind of response from the department. Deadlines are often flexible as well; if a deadline is closing in and you are still anxiously awaiting another school's response, call and ask for an extension on the deadline. Of course, when you have made a firm decision and have accepted an offer, you should inform all other schools of your choice.

3. *Don't mail out your packets too early or too late.* Mail your packets out within a month or so of the deadline advertised, usually in late December or early January.

4. *Don't let your talk run too long*. Most talks are 50-55 minutes although you should check with your host about their institution's expectation. Even if there are some technical difficulties or a lot of questions, people will expect you to speak for just under an hour. Structure your talk so that you can add or delete things (and not just at the end) depending on the time. Wear a watch. *Don't meet the time deadline by flipping slides and talking faster.*

5. *Don't be indifferent if you are asked "What would you like to teach?"* Have some ideas about the courses you would be best suited for. You can also use this as an opportunity to determine how classes are assigned to faculty. Are certain classes "owned" by particular faculty? Do faculty members trade off teaching certain classes?

6. *Don't make faculty feel that they are wasting their time.* They asked you to interview and you agreed to come. The department has spent considerable time, effort and funds on your interview. Even if it is becoming clear that this is the last place on earth you would want to be employed, these people will still be part of your research community. Be gracious, behave professionally and don't alienate anyone.

7. *Don't complain about your situation.* It appears unprofessional and petty to complain about fellow students, your advisor, previous interviews, etc. You will make the strongest impression by acting professionally rather than complaining.

5 AFTER YOU'VE GOT THE JOB

Congratulations! You have been through a long and arduous process and you have accepted an offer you like from a place you'd like to go. What do you do when you get there? The following brief subsections should get you started and on track for the first year or so.

5.1 ESTABLISHING YOURSELF AS A RESEARCHER

Just as you focused on getting a job from your first days as a grad student, you should focus on your tenure case from your first days as an assistant professor. Get a realistic picture of what it takes to get tenure at your institution. What kind of publication record is expected? What is the relative balance of research, teaching, service and grants for successful tenure cases? Figure out what your university values and focus on building your tenure file in those areas.

To establish yourself as a researcher, you need to do two things: perform good research, and communicate your work to your professional community. One focus of your first year should be to develop a research program. Spend some time thinking about the problems you want to work on beyond your thesis and develop a strategy for attracting students to work with you on these problems. Talk with your former advisor or other trusted colleagues about research directions and strategies. (Note that in many places, you will need to demonstrate at tenure time that you can work independently of your former advisor so spend some time focusing on a research thrust that is not collaborative work with your advisor.) At tenure time, it will be important for you to demonstrate that you have a research track record in a well-defined research area in computer science.

A good way to attract students is to give graduate classes in your area of expertise. "Core courses" allow you the opportunity to come in contact with a wide variety of students. "Topics courses" allow you to focus on more advanced problems with students who are interested in the field. Both kinds of courses provide a good opportunity for meeting and evaluating potential students. You should also consider joining or starting a regular research seminar in your area. The formats of these seminars differ from place to place, but they typically provide a way to build a research group in a particular area and keep up on the latest results.

Attracting students will help you conduct your research; going to conferences, meetings, and giving talks will help you communicate your research. There are several important reasons for doing this. At tenure time, your institution will ask for letters which review your work from the prominent people in your area. It is important that these people know what you have done and have positive things to say about it. When you go to conferences and meetings and give talks about your work, you are educating your colleagues about what you do. In addition, the better known you are in your research community, the more likely other opportunities will be open to you: program committees, funding, policy groups, etc. Although most assistant professors do minimal national service activities before tenure, requests to be on program committees, participation on NSF panels or in professional organizations, etc. are important opportunities and should be considered seriously. Being known to the prominent people in your area who are doing these activities (and who will probably be asked for letters about your research) can help you through the next transition. Note that networking with your colleagues early on can generally improve the letters your colleagues will send, and will provide a long history with which your colleagues can better describe the maturation of your work.

Since the permanent record of your research is your papers, you will want to start writing papers your first year. This is the time to get the papers from your thesis out of the way. You may not want to work on them as your research focus changes and you begin to move on. The other thing you should do in your first year is to write a grant proposal. The NSF has programs for new faculty and you should apply to that. Apply for a NSF Career Grant. Having your own money to support your research and your students is critical in most areas and you will want to start on this in the fall of your first year.

5.2 ESTABLISHING YOURSELF IN THE DEPARTMENT

Now that you have joined your department, you will become part of the departmental group dynamic. *Get a good picture of the power structure in your department before you jump in.* You will need to figure out who the reasonable people are, who the powerful people are, and how faculty members interact with each other. You will need to determine where you fit in to the political spectrum.

It will be helpful if you can establish a relationship with someone in your department who can mentor you. Basically, you need information about what your best strategy for tenure might be and how to deal with a multitude of day-to-day issues. Look for reasonable people in your department, and listen to what they say about the department dynamic. Develop good relationships with these people. Overall, your aim is to develop a collegial and professional interaction with *all* of your colleagues.

Don't forget to put effort into developing good relationships with secretaries, administrative staff, and systems people. These people make the department run smoothly and their support can be incredibly valuable to you. Besides, it's the right thing to do.

Your first year is going to be challenging. You will be starting in a new place, teaching courses, serving on committees, writing grants and papers, establishing your research, and developing relationships with colleagues, staff and students. *Don't volunteer for everything.* You may want to demonstrate that you're a team player and volunteer for specific things, but don't go overboard. Everyone will understand that you need to pace yourself.

5.3 TEACHING

As a university professor you will be asked to teach. Your teaching load may vary accordingly to your institution, career level and negotiated offer. Have a realistic notion of how important teaching is at your institution. In many research institutions, good teaching is encouraged but not necessarily rewarded at promotion time. On the other hand, poor teaching may make career transitions to the next level more difficult. Whatever your situation, do the best job you can in your courses. Your students deserve it and being well prepared can also help you with your research. You will need to

prioritize all of the things that are expected of you: research, teaching, committee work, etc. Be realistic about how to prioritize your time based on what you want the outcome to be.

If you can teach courses in your area, that will help your research. You may also want to minimize the number of new courses you teach per year. Consider carefully the mix of grad and undergrad, area and out-of-area, core and specialty courses you want to teach.

When you teach, be especially well prepared the first few weeks of class. Once you have established your credibility with the students, you will find the situation is easier. More information on teaching strategies can be found in the chapter on teaching.

5.4 HAVING A REAL LIFE

Although almost nothing in your professional life will encourage you to have a real life, do it anyway. Nurture your real life. Do it for yourself and your family and your friends. Do it for your research. Research is a creative process and you need to have the resources to do your job. Your real life provides time for you to regroup and refresh. It is important for you and it is also the best strategy for improving your professional life. You might be surprised to know how many of your professional colleagues run marathons, lead Brownie troops, sing in rock groups, raft down the Colorado River, etc.

Have friends who are not computer scientists. Have friends who are not academics. There is a whole world of people out there and all of them have important things to offer you. Moreover, having a real-life perspective will help you deal with the ebbs and flows of your professional life.

Which brings us to a controversial point: be discreet about your real life. You may be at the top of your form on Monday because you spent the weekend reading and resting, but until they know you well (and sometimes even after that), your colleagues may not consider that nearly as credible as if you spent the weekend writing a paper. Learn when to share that you are leaving work to take your son to Indian Guides and when it works better for you to say that you are leaving for an off-campus meeting. Each department and each group of people is different about this. Be sensitive about what you need to do to convince your colleagues that you are both serious and credible. But don't let it stop you from having a real life.

6. PURSUING A CAREER IN INDUSTRY

Although there are many similarities between pursuing a career in academia and pursuing one in industry, there are many differences as well. In industry, there is a wide spectrum between research and development, and between research and development (R&D) and marketing and sales. We touch very briefly on careers in industry here.

6.1 CAREERS IN INDUSTRIAL DEVELOPMENT

The main goal of a development group is to produce some kind of product. Many people find great satisfaction in being part of the development of a "finished product" and seeing the direct utility of their work. Knowing that the product you helped develop may be used by millions of customers can be extremely rewarding. However because the work is product-driven, development jobs can be stressful. Schedules are tight, and the company may realize an immediate loss or problem when deadlines are not met. There can be enormous repercussions if you have promised a client a product and you cannot deliver on time. On the other hand, meeting deadlines can yield big pay-offs in terms of money and advancement. If you do a great job in a development group, considerable opportunities may become available to you. A career in development often means taking big risks for big payoffs.

Your work with a development group may be either very well defined and/or described entirely by someone else. In addition, the focus of your work may change depending on your position in the development group and how high up in the company's hierarchy you are. If you are a new member, however, it is likely that someone else will tell you what to work on with more or less input from you.

6.2 CAREERS IN INDUSTRIAL RESEARCH

Research in industry is quite different from development. There are actually only a few "basic research" jobs in industry. Many of the larger companies have research labs (AT&T, IBM, Microsoft, etc.) but many of the positions are not entry-level, and in general the number of opportunities in this area is small compared to academia. More common in industry are interdisciplinary jobs on the interface between engineering and computer science, or between computer science and mathematics. These jobs often require excellent communication skills—both verbal and written. If you are working with somebody with a different technical background than you, it is incumbent upon you to be able to communicate information in a concise and understandable manner.

Applied research jobs are positions that exist in nominal development groups. Applied research can mean many things. It might mean your research will progress in a particular application area, like product development or software. Or perhaps the research will focus on hardware development areas.

One issue to keep in mind if you are interested in research positions in industry is the ultimate goal of industrial vs. academic research environments. In industry, the profits of the company support the research that the company performs. This means that when times are good, the company can expand its research efforts and support more basic and undirected research. When times are bad, the research group may be the first group to be considered for cuts. If you work in an industrial research group, be clear as to what the company's long-range goals are, what the marketing and development strategies are, and how what you are doing relates to them.

6.3 ACADEMIA VS. INDUSTRY: A DISCUSSION

In industry, there is a much broader range of opportunities, as well as many more jobs as compared to academia. Moreover, you do not need to work in an industrial research group to do research. A lot of research is accomplished in development groups despite a lack of freedom in determining the problems. Industry also provides geographic flexibility. If you are restricted to a particular geographic area or are faced with a two-body problem, industrial jobs may provide more opportunities than academic positions. In addition, industrial jobs typically carry higher salaries, stock options, bonuses, and other tangible rewards for good work.

On the other hand, academia provides a different flexibility. R&D in industry is restricted to the progress of the company; what you choose to work on in academia is something that you determine. In an academic job, you will determine your research goals, your daily work schedule, when you work, where you work and with whom you work.. Academics can often choose their teaching schedules, students, and summer activities to support their research efforts. Academics have the freedom to go to conferences, take sabbaticals, and visit other places as part of their work. In addition, tenure provides long-term job security.

Teaching is generally a required part of academic jobs. Mentoring students and teaching courses is an important part of the job and can be time-intensive. In industry, you often do not have regular contact with students. Although helping students get "up to speed" may not contribute directly to your research effort in academia, interactions with students can raise new issues, force you to look at different viewpoints, and keep you current with your field. In many industrial positions, you have to make a conscious effort to keep current in your field, keep abreast of the literature, and generally know what's going on. In academia, keeping current is more or less part of the job.

6.4 INTERVIEWING WITH AN INDUSTRIAL RESEARCH GROUP

The objective of an interview in an industrial research group is the same as that of the academic interview: to find out if you would be happy with the job. You must decide if the company's goals and your research interests are compatible.

There are several important matters to discuss with your interviewer and the people you meet throughout the day. Find out what the distribution between applied and undirected research at the company is. Often it is not obvious unless the company is huge. How is research directed in the group you are interested in? Decide if you need a position that provides some flexibility in research, or if you are content with some external guidance. More to the point, ask to whom you will have to report and how you will be evaluated. You want to see if you can fit in within the group. Does the group comprise many individual efforts, or does everyone work together? How does the manager view the

group's goals in relation to the company's goals? What development groups in the company will your group interact with? What resources will you be provided? What kind of hardware and software will you use? All of this information will give you a feel for the rules of the group.

You also should get a sense of your career options within the company. Find out what the career paths are and what the salary levels are. Perhaps you are interested in research management--how is the hierarchy organized? Some companies have administrative, management, and purely scientific career paths, and some do not. You want to be sure you will be happy with how your salary will scale as well.

You should also be clear about the company's policy on publications. Some companies do not allow you to publish for fear of revealing company secrets. Some companies will however encourage you to publish a lot. Some will even provide travel support so that you can give talks and get involved in professional activities within the research community. This is important because you may need or want to maintain connectivity to the your professional research community. Find out how far the company is willing to go to support you in these ventures. Finally, try to meet with your future colleagues in a less formal setting if possible. You want to make sure you are comfortable with them as a group.

6.5 ON THE JOB

The best way to survive and to succeed is to do great work. As in academia, it is easy to get side-tracked in industry by volunteering to do more projects, or to get too heavily involved in work that digresses from your own. If you see something that needs to be done and you can convince others that it is important, do it. That kind of initiative can be very well rewarded. Analogous to choosing a departmental mentor, you should also seek a good industrial mentor. Seek someone who can guide you technically and with whom you can get along. Stay in tune with what is going on in the company as well as what is going on in the research community outside.

Finally, be careful of social relationships within the company and your group. Dating colleagues or your manager is a high-risk proposition. There are many examples of both long-term partnerships that began as working relationships, and of relationships that soured a professional environment. Such relationships are often tougher for the junior person, so use good judgment.

7. EPILOGUE

The best advice in looking for a job is to know as much as you can about the process. *Knowledge is power*, and knowing how candidates will be selected for a job, the manner in which they will be evaluated, and the potential promise and pitfalls of the jobs you

apply for can help a great deal. With this in mind, you can optimize your chances to find a job that is both rewarding and satisfying.