Grant Proposals

Purpose: Convince reviewers and program director to give you money.

- **Research problem is important and significant.**
- **You are capable of solving the problem within the proposed time and budget.**
- **The money they will supply will be well-spent.**

NSF Proposal Review Criteria

1. **Research performance competence**—Capability of the investigator(s), the technical soundness of the proposed approach, the adequacy of the institutional resources available, results of prior NSF support. Please include comments on the proposer's recent research performance.

2. **Intrinsic merit of the research**—Likelihood that the research will lead to new discoveries or fundamental advances within its field or have substantial impact on progress in that field or in other fields.

3. **Utility or relevance**—Likelihood that the research can contribute to the achievement of a goal that is extrinsic or in addition to that of the research field itself, and thereby serve as the basis for new or improved technology or assist in the solution of societal problems.

4. **Effect of the research on the infrastructure of science and engineering**—Potential of the proposed research to contribute to better understanding or improvement of the quality, distribution, or effectiveness of the Nation's scientific and engienering research, education, and human resources base.

NSF Ratings

Excellent Top 10% of proposals in this subfield, highest priority for support.

Very Good Top 1/3 of proposals in this subfield; should be supported.

Good Middle 1/3 of proposals; worthy of support.

Fair Lowest 1/3 of proposals.

Poor Proposal has serious deficiencies; should not be supported.

In practice, you need a score of at least 1 Excellent and 2 Very Good's to get funded from CISE.

Proposal Contents

- **Long term goals**. These provide the framework and justification for the proposal.
- **Significance.** Explain why the proposed work is significant. Who would care if it succeeded? What difference will it make?
- **Specific goals.** Specific things to be achieved during the grant period.
- **Methods and Experiments.** What methods will you apply to achieve the goals? What experiments will you perform?
- **Feasibility.** Evidence that the goals are achievable by you. Assessment of the difficulty of the goals; prior experience with similar goals and methods.
- **Risks.** What could go wrong? How will risks be minimized?
- **Current State of Knowledge**. What is currently known about this problem?
- **Timetable.** Demonstrates feasibility, especially within time constraints.
- **Budget.**
- **Budget Justification.** Every item of the budget should be essential to the success of the project. Explain this.

Proposal Outline

- **Project Summary.** 250-word abstract describing the project and its significance.
- **Goals and Significance**. Describe the long term goals, the short-term goals (briefly), and their significance. May need to briefly review prior work to set the stage.
- **Previous Research.** Current state of knowledge. Include your own research here to demonstrate your knowledge and project feasibility. Cite all potential reviewers. May need to include a tutorial on this area.
- **Specific Goals.** May interleave with methods and experiments.
- **Methods and Experiments.** Give sufficient detail to assure reviewers of feasibility and of your ability to do them. Risky outcomes should be accounted for in the design.
- **Timetable.** Brief list of specific tasks and expected time when they will be completed.
- **References.**
- **Budget and Budget Justification.** This is usually a separate section.
- **Other Materials** CV of investigators; letters of support from and collaborators. Letters verifying unusual items (e.g., institutional matching funds, etc.)

Thesis Proposals

Same except for financial component.

Body should be only 12 pages.

References should include papers you plan to read, and annotations for papers you have already read.

Project Design

- Impact and significance
- Required skills
- Inherent interest
- Feasibility and competition
- Phase of research; extendability
- Opportunities for learning new skills

Different Talks Have Different Goals

- **Conference Talk.** An audio-visual abstract.
  Communicate the main idea and its significance.
  Advertisement for the proceedings paper.
- **Seminar.** Guided tour through a piece of research.
  Three main ideas.
  Detailed results.
  Significance and discussion.
- **Job Talk.** Similar to seminar, *but...*
  Show breadth of knowledge, techniques, interests
  Demonstrate teaching skills (relate to students in audience)
  Show viable research program.
- **Oral Exam.** Similar to seminar, *but...*
  Aimed at your committee.
  Demonstrate that you understand the setting and significance
  Demonstrate that you have made a contribution
  Demonstrate completion of a body of work.

General Rules

Rule 1: Know your audience

- How much background do they have?
- Do they share your assumptions?
- Is it mixed? (faculty + students; researchers + practitioners)

- **Conference Talk**
  The whole audience should understand your problem, its significance, and the main intuition behind your solution.
- **Seminar**
  The whole audience should understand the problem and its significance. (First 10 minutes of talk)
- **Job Talk**
  Every member of the audience should understand at least one of your results.
- **Oral Exam**
  The committee should understand everything.

Rule 2: Be visual

After you have outlined your talk and the main points you want to make, try to turn every point into a picture.

Present no code (unless it is a programming language talk).

Present no math if you can avoid it.

Use examples and pictures.

[This slide fails!]

Rule 3: Tell A Story

Your introduction should raise an issue, ask a question, present a puzzle.

Your talk should resolve the issue, answer the question, solve the puzzle.

The story grabs the audience and keeps them oriented. It also helps you serialize the talk.

Rule 4: Don't Lose Your Audience

This is rarely a problem for conference talks. But in all other talks, it can be a serious problem.

- **Give an Outline**

  Repeat it if necessary at various break points in the talk.

- **Don't assume the audience knows too much**

  Don't be afraid to tell them things they should know.

- **Relate each point to the story**

- **Pace the presentation**

  Break up difficult material.

- **Consider asking them questions.** (for seminars; job talks)

Tell them you will tell them. Tell them. Tell them you told them.

Rule 5: Practice!

Practice your words for each slide.

Practice starting and ending.

Practice before an audience—especially have them ask the hardest questions they can think of.

Practice your timing; have a few checkpoints and know how much time should be remaining at each.

Do's

- **Make it Readable**. Large fonts. Minimize words.
- **Stand by screen**. Not by the projector. Point to screen.
- **Look at audience**. Make eye contact. Watch for reliable listeners.
- **Minimize slide changing time**. Overheads are clumsy. Talk while you are changing slides—use that time well.
- **Use color if possible.** Especially for data and pictures. Colored text is usually distracting.
- **Use humor.** Humor that relates to the topic can be very helpful, especially to break up difficult material.

Don't

- **Don't talk down to your audience.**
- **Avoid fold-over overlays.** Reproduce the whole slide with the changes.
- **Avoid fancy slide handling**. Don't expect to be able to find an earlier slide. Duplicate it if you need it again.
- **Avoid progressive uncovering.** This is frustrating to the audience. Use multiple, simple slides.
- **Don't read your talk.** Don't refer to your notes unless you are lost.

Talks, Jobs, and Papers

Conference talks are important in getting your name known to potential employers.

Journal papers are important for getting an interview (and for tenure).

Your job talk is the one piece of your interview that you have the most control over. It should be perfect.

Ethical Issues

- Plagiarism and theft of ideas
- Claim of non-existent results
- Fear of negative results
- Duplicate publication; least-publishable-units (LPUs)
- Conflict of interest, proprietary information

Scenario 1

You are talking with a colleague about the projects of his graduate students. He tells you about a very clever idea by one student that solves a problem you have been trying to solve for months. What do you do?

- Go home, implement the idea, and publish a paper before the student can publish.
- Try to think of a better idea.
- Contact the student and suggest collaborating on testing the idea.

Scenario 2

You are writing a grant proposal. To support the proposal, you have done some preliminary experiments. Some of the experimental runs were lost during a system crash, but if they had come out right, you would have statistical significance. What do you do?

- Claim that the results came out the way you wanted them to.
- Report the initial, incomplete results.
- Omit them from the proposal.

Scenario 3

You are writing an annual progress report on your grant. During Year 1, your project plan called for completing the translation of a program into a new language. Although you have started work on this, you are only about half-way done. Furthermore, you haven't accomplished any of the other first-year goals. What do you do?

- Claim that the translation is completed.
- Claim that the translation is half-completed.
- Discuss new, interesting research issues that arose during the first year.

Scenario 4

You are testing the effectiveness of a new technique on eight application problems. You have completed the test in six of the eight, and the results are very strong. You are afraid that the technique might not work on the remaining two problems, and the technique is very time-consuming. What do you do?

- Ignore the remaining two problems.
- Perform the tests, but ignore them if they turn out wrong.

Scenario 5

You decided to do the test in the seventh problem. The method did not improve performance there. What do you do?

- Ignore the bad result.
- Do further experiments to understand why the method failed in this problem.
- Find a way to make it work in this problem; then publish.

Scenario 6

You have finished a piece of work and you want to present it in a conference. There are three possible conferences you could submit it to (A, B, and C). The acceptance rate at each conference is very low (less than 20%). What do you do?

- Submit to all three conferences.
- Choose the most appropriate conference and submit there.
- Write three slightly different papers, and submit one to each conference.

Scenario 7

Slightly different versions of the paper have been accepted at conferences B and C. What do you do?

- Modify B to include material from A. Present the paper at both conferences.
- Withdraw the paper from conference C, since B is the more appropriate audience.

What if conference B is a CS conference, while conference C addresses the application community?

Scenario 8

You have finished a piece of work that could be broken into three small journal papers or published as a single large paper. What do you do?

- Publish the three small papers, in three separate journals.
- Publish a single large paper.

Scenario 9

You have received a grant proposal to review for a person that was a good friend of yours in college (before you both decided to go the graduate school in Computer Science). What do you do?

- Send the proposal back with a note indicating that you have a conflict of interest.
- Review the proposal, but attach a note describing your relationship with the person.
- Review the proposal and say nothing.

Scenario 10

You have accepted a consulting job at a software company where you discover an interesting research problem. The company does not plan to work on this problem, but if a solution were known, the company could potentially exploit it to make millions of dollars. What do you do?

- Have a graduate student work on the problem, and send copies of all results to the company (without the student's knowledge).
- As above, but with the graduate student's permission.
- Set up a contract with the company whereby they will fund the graduate student in return for exclusive license to the results.
- Set up a contract with the company whereby they will fund the graduate student in return for non-exclusive license to the results.
- Suggest that the company hire the graduate student to work on the problem at the company.
- None of the above.

Scenario 11

The company bought the exclusive license. The student solved the problem and wants to publish the results. The company is trying to hold up publication as long as possible so that they can finish implementing and testing a product based on the idea. You are the student. What do you do?

- Publish the results anyway.
- Convince the University to enforce the contract provisions, which state that the company can delay publication for up to 90 days.
- Go along with the delay, because under the contract, you will get a percentage of the license fees.

Scenario 12

You and your advisor both work for a small startup company. They want some experiments performed for which they lack the software tools and hardware. The tools and hardware are available on campus. What do you do?

- Perform the experiments on campus.
- Refuse to perform the experiments on campus.

Scenario 13

Now you graduate, and you go to work for a competitor of your advisor's company. You signed non-disclosure agreements with that company that bind you for 12 months. The new company is working on a product that has run into serious problems. Information you learned at the other company would solve those problems. What do you do?

- Nothing.
- Tell your co-workers how to fix the problems.
- Consult a lawyer.

How To Choose A Research Problem

- **Questions about yourself**
- **Questions about context**
- **Questions about the lifecycle**

Questions About Yourself

- **What research skills do you excel at?**
- **Where in the lifecycle are those skills most needed?**
- **What kind of outcome do you seek?**

  Satisfaction from being a competent researcher?

  Solving important societal, commercial, or scientific problems?

  Transforming the way computers are programmed?

  Transforming the way current users employ computers?

  Bringing computation to a new kind of user?

  Starting a company and making a fortune?

Questions About the Context

- **What new technologies may drive change?**

  How will these technologies shift tradeoff points?

  What new problems will they introduce?

- **What kinds of new users are potentially out there?**

  What are their problems?

- **What application areas are very messy and need formalizing?**

What Research Contributions Do You Most Admire?

Contribution	Characterization
RDBMS	Formalize, simplify, abstract
HARPY	Import, formalize, and simplify
RISC	New technology
PC (alto)	New technology and new kind of user
BRAVO	New technology and new kind of user
OOP/smalltalk	New kind of user
VISICALC	New kind of user
MYCIN	New kind of user
SCRIBE/latex	New kind of application
postscript	New kind of application
GIS	New kind of application
Mathematica	New kind of application
Mosaic	New kind of application
Backpropagation	New unit
ID3	New unit

Research Strategies

- **Technique-Driven Research**
  Primarily interested in a technique (e.g., machine learning), look for applications of it. Much of computer science is here.
- **Problem-Driven Research**
  Primarily interested in a goal (e.g., "dynabook", databases, digital library), use whatever methods are appropriate.

Technique people learn about many applications.
Problem-driven people learn about many techniques.

Success is Hard to Predict

You cannot pursue all interesting or promising research paths.
Ultimately, you must "place your bets."

You will probably be wrong—otherwise, it wouldn't be research.
But you will learn something along the way.