THE HONOR ΦΚΦ SOCIETY OF

PHI KAPPA PHI

FELLOWSHIP PROGRAM

For the support of students entering their first year
of full-time graduate or professional study.

Awards For Year 2010–2011

APPLICATION PACKET

You will need three copies of the
Letter of Recommendation Request Form found on the following page

For further information:
(800) 804-9880, ext. 35
Fax: (225) 388-4900
E-mail: mdavis@phikappaphi.org

PhiKappaPhi.org

PRINT THIS PAGE THREE TIMES.

The Honor Society of Phi Kappa Phi

LETTER OF RECOMMENDATION REQUEST FORM

Those supplying recommendation—please return request form with your letter of recommendation in a sealed envelope to the applicant.

First part to be completed by applicant

Name of Applicant _____

Name of Person Recommending Applicant _____

(*Optional*) I hereby waive my rights of access to this confidential evaluation report, as provided in the Family Educational Rights and Privacy Act of 1974.

_____ _____

Applicant's Signature *Date*

INSTRUCTIONS TO PERSON PROVIDING LETTER OF RECOMMENDATION

The above applicant has identified you as one who knows and can evaluate his/her qualifications for a Phi Kappa Phi Fellowship. **In no more than 350 words (must be typed)**, please indicate your impressions of the applicant's (1) scholarship with particular reference to capacity for original work as a graduate student; (2) character and personality attributes, or other observations that will assist in appraising the applicant's probable success in advanced study and in potential career contributions. If you wish to put your statement on your letterhead and attach it to this sheet, you may do so. **Please fill in the blanks and sign on the bottom part of this page.**

- I have known the applicant for a period of _____ years and/or _____ months.

- I have served as the applicant's _____ teacher in one class _____ teacher in several classes
  _____ department chair _____ academic advisor
  _____ Other, explain _____

- Among approximately _____ senior students I have known in this field over the past _____ year(s), I would rank this applicant in the upper _____%.

Signed _____ Title _____ Date _____

Please return this request form with your letter of recommendation in a sealed envelope to the applicant, with the following typed in the mailing address section of the envelope:

RECOMMENDATION FOR (APPLICANT'S NAME)
THE HONOR SOCIETY OF PHI KAPPA PHI
2010-2011 FELLOWSHIP PROGRAM

Phi Kappa Phi Fellowship Program
GENERAL INSTRUCTIONS AND ADVICE TO APPLICANTS
for Completing Fellowship Application

Before completing the Fellowship application, carefully read all instructions and information that follows and review the *Phi Kappa Phi Fellowships Fact Sheet*.

DEADLINES

February 3, 2010 — A complete application must arrive at your local Phi Kappa Phi chapter on or before this date. A complete application consists of:

- Six-page 2010–2011 Application Form (Form #FEL 9.09)
- Official Academic Transcripts
- Standard Test Score Reports (GRE, GMAT, MCAT, LSAT, etc.). If test scores are not required, attach a copy of one or two pages from your portfolio or an example of your creative work, e.g. CD, DVD, slides, or several pages of a manuscript.
- Three Letters of Recommendation

Note that the February 3 deadline allows for each chapter to review submitted applications and to select the ONE applicant to represent the chapter as their nominee in the national competition.

February 17, 2010— Chapters are required to submit the materials of the ONE applicant they have selected as their nominee for the national competition to Phi Kappa Phi Society Headquarters so that it arrives on or before the February 17 deadline. **Any materials received after the February 17 deadline will be disqualified.**

INSTRUCTIONS TO APPLICANTS

1. OBSERVE DEADLINES. Remember that the application must be submitted to your Phi Kappa Phi chapter by the February 3 chapter deadline.
2. Do not use application forms from previous years. Only Application Form #FEL 9.09 will be accepted. No others will be considered for the competition.
3. **Applications must be typewritten.**
4. Type all material in no smaller than a 10-point font size.
5. Please answer every question as fully as space permits. **Do not add supplemental sheets** other than transcripts, standardized test score reports or creative work, and letters of recommendation.
6. Be clear, concise, complete, organized, and orderly in preparing your application.
7. Complete all sections of the application form and include all appropriate and relevant information.
8. Clearly identify your rationale for selection of the graduate institutions you have chosen.
9. Give attention to your personal statement. Include an explanation for weaknesses or anomalies in your grade reports and "gaps" that exist in your record, e.g., periods of inactivity in your academic pursuits.
10. Exercise care in selecting the persons who will supply letters of recommendation. Be sure to stress to them that letters must be typed.
11 PROOFREAD your application.
12. Submit **one original and five copies** of your application and supplementary documents (except for sealed transcript(s) and Letters of Recommendation) to your chapter.
13. ASSEMBLE ORIGINALS IN THE FOLLOWING ORDER: Application Form #FEL 9.09, Transcripts (sealed), Test Score Reports, Letters of Recommendation in sealed envelopes. (Your chapter officer will open and make copies of sealed documents.)
14. Complete the Applicant Checklist and read and sign the *Applicant's Certification* on page 6. This indicates that should you be selected to receive a Phi Kappa Phi Fellowship, you understand and accept the responsibilities, obligations, conditions, and possible causes of revocation of the award.
15. Maintain a copy of your application for your records. *Application materials will not be returned.*

IF SELECTED TO RECEIVE A PHI KAPPA PHI FELLOWSHIP

Recipients of Phi Kappa Phi Fellowships will be required:

- To provide a recent original color photograph and a brief biographical sketch for publicity purposes.
- To pursue the proposed course of study at one of the institutions listed, unless prior approval of changes in plans is secured from the Fellowship Committee.
- To pursue graduate or professional study as a full-time student and to maintain a high level of scholarship and good standing.
- To submit, on time, any reports required by Phi Kappa Phi and to notify the Society Headquarters of any circumstances that may significantly alter student status.
- At the completion of the Fellowship year, to submit within 30 days a summary report of accomplishment (approximately 350 words) to the Society Headquarters.
- Fellowship grant funds will be disbursed once the Society has received the completed certificate of registration.

NOTE: This application may be completed (but not submitted) online at PhiKappaPhi.org. For more information, call Society Headquarters at 1-800-804-9880, ext. 35.

THE HONOR ΦΚΦ SOCIETY OF

PHI KAPPA PHI

APPLICATION FOR FELLOWSHIP

FOR ACADEMIC YEAR 2010–2011

Submission to Chapter Deadline: February 3, 2010

APPLICANT INFORMATION ☑ Male ☐ Female

Active Member? ☑ Yes ☐ No (annual dues paid through March 31, 2010)

Name: Matthew Jonathan Gardner
first middle last

Phi Kappa Phi Chapter Affiliation: Brigham Young University #058
chapter/institution name *chapter #*

Mailing Address: 795 Walnut Ave.
number and street

Provo UT 84604
city state zip code

Permanent Address: 795 Walnut Ave.
number and street

Provo UT 84604
city state zip code

Telephone No.: 801-995-9460 E-mail Address: mjg82@byu.edu

Undergraduate Field(s) of Study (Major): Computer Science

Minor (if applicable): Physics and Mathematics

Degree: Bachelor of Science Date Degree Expected: April 2010

Proposed Field of Graduate or Professional Study: Computer Science

Graduate or Professional Degree(s) to be pursued (i.e., Ph.D., M.Ed., M.D., etc.): MS

Please indicate how you learned about the Phi Kappa Phi Graduate Fellowship Competition (check all that apply):

- ☑ Local Phi Kappa Phi Chapter Officer
- ☐ Announcement Poster
- ☑ Phi Kappa Phi Web site
- ☐ Phi Kappa Phi E-Mail
  - ☐ From Headquarters
  - ☐ From Chapter
- ☐ Friend
- ☐ College/University Office
- ☐ *Phi Kappa Phi Forum* (magazine)
- ☐ *Monthly Mentions* (E-zine)
- ☐ Chapter Workshop
- ☐ Phi Kappa Phi Information Fact Sheet
- ☐ Faculty Member
- ☐ Other, explain _____

SUMMARY OF EDUCATIONAL BACKGROUND

(Include only post-high school institutions: academic, professional, technical, etc.) Note: The applicant may not have earned credit for a full term of graduate study or its equivalent in any field prior to the 2010–2011 academic year.

List All Institutions Attended:

Name & Location	Dates Attended	GPA (on 4.0 scale)	Degree(s), Certificate(s) or Diploma(s) received or expected and approximate date(s)
1. Brigham Young University, Provo, Utah	September 2004 - April 2010	4.0	BS in Computer Science in April 2010
2.			
3.			

A. LETTERS OF RECOMMENDATION

Indicate below the names, positions and phone numbers of three university professors or other persons who are able toattest to your academic ability, personal qualities, and achievements in letters of recommendation.

It is your responsibility to request **typed** letters of recommendation from these three individuals. To do this you must provide them with a copy of the **Recommendation Request Form** from this packet and ensure that the completed Form is returned to you **in a sealed envelope so that you may submit it with your application.**

1) Kevin Seppi, Associate Professor of Computer Science, 801-422-4619
name *position and field (if applicable)* *phone number*

2) Michael Goodrich, Professor of Computer Science, 801-422-6468
name *position and field (if applicable)* *phone number*

3) Eric Ringger, Assistant Professor of Computer Science, 801-422-7615
name *position and field (if applicable)* *phone number*

B. ACADEMIC RECORD.

Transcripts or other official evidence of academic record at all college or university-level institutions attended **must** be submitted as a part of the application. **Summarize** your record below, grouping by subjects such as mathematics, languages, history, etc. List the number of semester or quarter hours in which you received an A, B, C, or D in each subject group. Leave blocks blank when not applicable. If grading systems are different, make necessary adjustments.

SUBJECT GROUPS	Number of Semester or Quarter Hours by Grade						
	A	B	C	D	PASS OR UNGRADED	CLEP OR ADV. CR.	FAILED
Computer Science	56						
Physics	16				.5	3	
Mathematics	12					8	
Other Science	10					7	
Humanities and Foreign Languages	18				4		
Other	17.5					4	
TOTALS	129.5				4.5	22	

C. HONORS PROGRAM INFORMATION

Does your institution have an honors or curriculum enrichment program? [✔] Yes [ ] No.

If so, did you participate? [✔] Yes [ ] No.

If **yes**, describe the nature of your involvement, including honors thesis, projects, etc.

If **no**, explain why you did not participate.

The honors program at Brigham Young University requires a thesis and what is called a "Great Works" requirement, where students must read classic works of literature, view art exhibits and films, attend concerts and plays, and write responses to these experiences. These experiences broadened my appreciation for a variety of disciplines, extending my focus beyond strictly scientific endeavors. A significant amount of service in the school and community is also required. I fulfilled all of the requirements and will graduate with honors; some of the specifics are described in more detail in other sections. Along with fulfilling the requirements for graduation with honors, I served for a time in the honors student advisory council, helping to improve the honors program.

Identify research and/or creative endeavors in which you have participated.

I have spent the last two years doing research with Kevin Seppi at BYU. My work has resulted so far in one published paper, one paper currently under review for a computer science conference, and two more that will soon be submitted for review to computer science journals, along with a presentation at BYU's Spring Research Conference and a forthcoming presentation at the BYU Studies 50th Anniversary Symposium. My research with Dr. Seppi has focused on particle swarm optimization, though I have also done work in Markov decision processes, value iteration, and natural language processing. I also have been working with a physics professor to solve a crystallography problem using particle swarm optimization. He plans to submit his work to Science soon.

D. ACADEMIC RECOGNITION AND AWARDS

List all your academic awards, recognitions, honors received as an undergraduate: scholarships, research grants, publications, juried shows, recitals, etc.

Scholarships:
National Merit Scholarship, 2004, 2007-2009
BYU Nominee for the Barry M. Goldwater Scholarship, 2009
Claricode Medical Software Essay Scholarship Finalist, 2009 (a national essay competition)

Grants:
Research grants from the Office of Research and Creative Studies (ORCA) at BYU for 2008-2009 and for 2009-2010

Honors:
Dean's List for 6 consecutive semesters (top 5% of students in the college of Physical and Mathematical Sciences)

Publications and presentations:
Andrew McNabb, Matthew Gardner, and Kevin Seppi. "An Exploration of Topologies and Communication in Large Particle Swarms," in Congress on Evolutionary Computation, 2009
Matthew Gardner, Andrew McNabb, and Kevin Seppi. "Speculative Evaluation in Particle Swarm Optimization," submitted to The Genetic and Evolutionary Computation Conference, 2010. Awaiting acceptance notification
The Use of Particle Swarm Optimization to Solve Crystallography Problems, presented at BYU's Spring Research Conference 2008.
Automatic Topic Discovery in 100 Years of General Conference Talks, presented at the 50th Annual BYU Studies Symposium.

E. UNDERGRADUATE AND COMMUNITY ACTIVITY AND LEADERSHIP

List activities in which you have participated since high school graduation (cultural, service, athletic, political, volunteer, employment) and leadership roles both on campus and in the community. Give dates and estimates of time (e.g., hours per week) involved in each activity. Distinguish between ongoing and one-time commitments.

1. On the campus:

   Service:
   Secretary of the BYU Unix Users Group, September 2009 to present, 2 hours per week
   Member of the Honors Student Advisory Council from September 2004 to April 2005, 3 hours per week
   Volunteer tutor in Mathematics and Computer Science, intermittent between September 2004 and present, averaging 2 hours per week

   Employment:
   Research Assistant to Dr. Kevin Seppi in the Applied Machine Learning lab at BYU, December 2007 to present, 20 hours per week

   Athletics:
   Member of an intramural (campus, not collegiate) soccer team, January 2010 to present, 1 hour per week

2. In the community:

   Service:
   Served for two years as a volunteer, full time missionary for my church, May 2005 to May 2007. I learned Spanish as part of my service, and spent all of my time for those two years in the service. That is why it took me 6 years to graduate. For six months of the two years, I was in charge of training and overseeing 20 other missionaries.
   Volunteer for teaching and language practice at the missionary training center, October 2008 to present, 2 hours per week

   Employment:
   Software Engineering Intern, Google Inc., May 2009 to August 2009, 40 hours per week. Official blog post describing my intern project can be found at http://google-tmads.blogspot.com/2010/01/track-cost-per-call-data-through-google.html

GRADUATE STUDY PROSPECTS

A. TEST SCORES

List your **percentiles** for all scored sections of the GRE, GMAT, MCAT, LSAT, DAT, or other appropriate tests for graduate admission. You are encouraged to take the appropriate standardized test for your discipline. Attach a copy of the test score report(s) and score interpretation sheet(s) (including any sheets verifying score percentiles). A photocopy of the report is acceptable.* If test scores are not required, then attach a copy of one or two pages from your portfolio, or you must submit an example of your creative work (e.g., a CD, DVD, slides, or several pages of a manuscript).

* **You must submit six copies**

GRE: Verbal: 95th percentile, Quantitative: 94th percentile, Analytical Writing: 81st percentile

B. GRADUATE STUDY PLANS

List, in order of preference, three institutions of higher education that you are prepared to attend. Your specfic reasons for selecting each institution are requested. You should have verified that you have a reasonable chance of being admitted to these institutions. Please remember that all awards are contingent upon attendance at one of the institutions listed unless approval to attend another institution is granted by the Fellowship Committee based on adequate justfication.

NAME OF INSTITUTION — CITY/STATE

1st Choice: Brigham Young University, Provo, Utah

Reason for selection:

I have already been working with a professor who has agreed to take me as a masters student. Because we've been working together already, I believe I will be able to finish my masters degree quickly. There are some papers I have been working on that are not yet published, but hopefully soon will be, and I have work to build off of for my masters degree. Staying here and finishing my work will put me in a much better position to get into a top PhD program, with a history of publications instead of planned publications.

Application status (Applied, accepted, etc.) Applied, awaiting acceptance notification

2nd Choice : Carnegie-Mellon University, Pittsburgh, Pennsylvania

Reason for selection:

CMU is one of the top computer science graduate schools in the nation, and most say it is the top school for machine learning, the field I wish to pursue. However, I am not applying to CMU for a masters degree, because I am confident in my acceptance to BYU, which is where I want to go for that degree. I hope to be in a better position to get into CMU after finishing my work at BYU, with a masters degree and several more publications. I will apply to CMU's PhD program when I finish my masters degree.

Application status (Applied, accepted, etc.) Not applied; will apply to the PhD program after finishing my masters degree at BYU

3rd Choice: Massachusetts Institute of Technology, Boston, MA

Reason for selection:

MIT is also one of the top schools in the nation, and growing up I always wanted to go to MIT. I have recently realized that CMU better suits my interests, so MIT is my second choice for a PhD program. As with CMU, I am not applying to MIT for a masters degree, as I want to get my masters degree from BYU, and I am quite confident that I will be accepted. But I will apply to MIT's PhD program when I finish my masters degree.

Application status (Applied, accepted, etc.) Not applied; will apply to the PhD program after finishing my masters degree at BYU

Other Choices: To what other colleges/universities have you applied? List them (in no particular order).

PERSONAL STATEMENT

Describe your educational and career goals and personal factors that have influenced your decision to pursue graduate or professional study. Limit your statement to the space provided below using a **minimum of 10-point type or larger.**

I was sitting in a meeting, talking into a microphone in Spanish, interpreting so that the non-English speakers wearing headphones could understand what was going on. I had interpreted like this many times in the last year, but this time got me thinking. What if you could get a computer do this, and do it well? I knew then that I had to change my major.

My major had been physics. My father got a PhD in physics from Stanford. His father got a PhD in physics from Harvard, and his dissertation--measuring the spin of the electron--won a Nobel Prize. His professor received the prize, but my grandfather was a physics professor for many years. My mother's father was on the Manhattan project. Suffice it to say, I grew up incredibly interested in physics, determined to get a PhD and go on to win a Nobel Prize some day.

Reality struck me around the time I started college, and I realized how very unlikely it was that I would actually get a Nobel Prize. I still wanted to pursue my education in physics, and hopefully make some significant contribution to the field, but my delusions of grandeur had subsided slightly.

As I went about my goal of a degree in physics, a few classes I took kindled my interest in another field: computer science. I enjoyed learning how to program a computer, but the field didn't supplant my love of physics until my experience with Spanish interpreting. I realized that the problems I could solve with computer science were a lot more interesting to me than physics.

With a newfound fascination for computers, I started looking into machine learning and natural language processing. I found that Dr. Kevin Seppi, a professor whose class I was in, was the head of the Applied Machine Learning (AML) lab at BYU, and the research he was doing piqued my interest. I began working for Dr. Seppi as a research assistant in December of 2007. My educational experience and my preparation for graduate school since then have largely been shaped by my work with Dr. Seppi.

My first project in the AML lab was simply running experiments, using particle swarm optimization (PSO) to help Dr. Campbell, a physics professor at BYU, solve a crystallography problem. Dr. Campbell had a model for what was happening inside of a certain class of crystals, and he wanted to fit the parameters of his model to the data he had collected. Evaluating the difference between his model's output and his data for each of tens of thousands of data points took several minutes, so we had to use a parallel optimization algorithm. PSO is well suited to those problems, so I gained experience both in how PSO works in general and in its use in a parallel environment. Early on I gave a presentation on how PSO can be used to solve crystallography problems at BYU's Spring Research Conference. Eventually I discovered that the algorithm wasn't converging well because there were correlated parameters in Dr. Campbell's model. After that discovery we quickly solved the problem. Dr. Campbell's work is still ongoing, though he plans to submit his work to the journal Science soon.

My initial work with PSO led me to a number of different projects. Using PSO in parallel led to some interesting research into communication among particles in the swarm. When running PSO in parallel, each processor controls a single particle, and communication between particles in the algorithm translates to inter-processor communication in the code. A lot of communication in the swarm, which is often desirable to quickly converge on a good point, can be very time consuming. To mitigate this problem, we devised a randomized topology that approximates the effects of highly communicative swarms with a much smaller communication cost. This work, along with some other results drawn from our experiments with large, parallel particle swarms, was accepted at the Congress on Evolutionary Computation in 2009, one of two top conference venues for PSO research.

Soon after that paper was accepted, Dr. Seppi presented me with another possibility for parallel PSO. In our earlier experiments, we had noticed that for some functions, small swarms performing many iterations find better values quicker than large swarms performing fewer iterations. Dr. Seppi wondered if it was possible to use extra processors in parallel to perform two iterations of the PSO algorithm at a time. I was intrigued with this idea and decided to make it my honors thesis. I developed an algorithm I called "speculative evaluation in PSO" that evaluates all of the possible next positions of each particle in parallel and picks the one that matches the actual behavior of the particles, accomplishing the goal of performing two iterations at a time. In addition to submitting my work to BYU as my honors thesis, the paper describing my new algorithm is currently under review for the Genetic and Evolutionary Computation Conference, the other of the two top conferences for PSO research.

After completing my honors thesis, I was still interested in seeing what further improvements could be made to speculative evaluation in PSO. For the past few months, I have been implementing my new ideas and running experiments, and within the next month I will be submitting a paper detailing my original algorithm and my improvements on it to Transactions on Evolutionary Computation, a top journal for PSO and related research.

Along with particle swarm optimization, through my research I have also gained an interest in natural language processing (NLP). I took a course in text mining that fascinated me, and that led me to work more closely with the head of the NLP lab at BYU, Dr. Ringger. Dr. Ringger taught me about latent Dirichlet allocation, an algorithm used to discover latent topics in large collections of documents. I used latent Dirichlet allocation to analyze a collection of about 8000 religious sermons given over the past 100 years. I discovered that the distribution of topics found in the sermons over time correlated very well with real-world events that were happening during those times, validating the algorithm and providing insight into the sermons themselves. That work has been accepted as a poster to the 50th Annual BYU Studies Symposium, and I will be presenting it there next month.

My research experience as an undergraduate has solidified my desire to pursue a graduate degree. I love solving new problems, and I am fascinated by the things that can be done with computer science.

APPLICANT'S CHECKLIST

To the applicant: Be sure that your application is complete by checking the following list:

- ☑ All six pages of the application are complete. (Use only Form #FEL 9.09.) Be sure your responses are confined to the space allotted on the application form. Do not add supplemental sheets other than those requested. **Any additional materials will be ignored.**
- ☑ Transcripts are enclosed for EACH college, university, or other post secondary institution attended in separate, sealed envelopes. (Your chapter officer is responsible for making five copies of transcripts.)
- ☑ Reports of standardized test scores and percentile rankings (GRE, GMAT, MCAT, LSAT, etc.) are included. (If you have taken the test, but not yet received the report, indicate on page 4, item A, the examination date and forward a copy of the results to the Phi Kappa Phi Society Headquarters immediately upon receipt.)
- ☑ Portfolio pages or samples of creative work (if applicable per instructions on page 4) included (**six copies of each**).
- ☑ You have not/will not have completed the equivalent of a semester or more of graduate study in any field.
- ☑ Three letters of recommendation in separate, sealed envelopes. (Your chapter officer is responsible for making five copies of the letters.)
- ☑ Verify membership status by calling 800-804-9880 ext 35. You must be an active member (dues paid) through March 31, 2010, or have accepted the invitation to join and have been initiated by June 30, 2010.
- ☑ You have read, signed, and dated the certification statement below.

APPLICANT'S CERTIFICATION

I hereby apply for a Phi Kappa Phi Fellowship and, if selected, specifically agree to comply with the following stipulations, and understand that failure to do so may result in the revocation of the Fellowship:

1. To pursue the proposed course of study at one of the institutions that I have listed, unless prior approval of changes in my plans is secured from the Society Fellowship Committee.
2. To pursue graduate or professional study as a full-time student and to maintain a high level of scholarship and good standing.
3. To submit an original color photo and brief biographical description for publicity purposes, which may include, but not be limited to, press releases, advertisements, Phi Kappa Phi publications both print and electronic, and any other venues used to promote and educate about The Honor Society of Phi Kappa Phi and/or its awards programs.
4. To submit, on time, any reports required by Phi Kappa Phi and to notify the Society Headquarters of any circumstances that may significantly alter my student status.
5. At the completion of the Fellowship year, to submit within 30 days a summary report of accomplishment (approximately 350 words) to the Society Headquarters.

I understand that The Honor Society of Phi Kappa Phi assumes no responsibility or obligations whatsoever beyond providing the amount of the award.

I understand that should I be unable to accept an award, the award may be granted to another nominee.

I have examined this application and certify that all information given in it is complete and accurate to the best of my knowledge. I have attached all required documents.

_____ _____

Signature of Applicant *Date*

REMEMBER!

Application must reach your Phi Kappa Phi chapter no later than February 3, 2010.

Chapters then identify from their pool of applicants the ONE applicant to represent the chapter in the national competition. Chapters must send their nominee's application materials to the Society Headquarters to arrive no later than February 17, 2010.