

## **Request to Plan a Doctoral Program in Computer Science at North Carolina A&T State University**

### **Introduction**

This is a request from North Carolina A&T State University for approval to plan a doctoral program in Computer Science (CIP: 11.0701).

### **Program Description**

The Department of Computer Science at North Carolina A&T State University (NCA&T), in accordance with the current goals of the College of Engineering at NCA&T, requests authorization to plan a Doctor of Philosophy in Computer Science degree program. With this program, NC A&T would be the only HBCU (Historically Black College or University) offering a computer science Ph.D., and it would be the sole doctoral program in computer science in the Piedmont Triad. The proposed Ph.D. program would be a natural extension of a very successful M.S. in Computer Science program, which was initiated in the fall of 1993 and has graduated approximately 300 students, more than any other M.S. program in the College of Engineering at NCA&T during the period from its inception.

Program goals include benefits for the graduates, the Computer Science faculty, and society at large. Thus, one goal is to prepare technically sound doctoral graduates for research and teaching in computer science at an advanced level. Regarding the faculty, another goal is to enhance their teaching and research capabilities through research-based interactions with doctoral students. Finally, there is the goal to increase the number of African-American doctoral graduates in computer science.

In addition, the proposed program would enhance cooperation between the Department of Computer Science and the other departments in the College of Engineering with Ph.D. programs, namely, Electrical and Computer Engineering (Ph.D. in Electrical Engineering), Industrial and Systems Engineering (Ph.D. in Industrial Engineering), and Mechanical and Chemical Engineering (Ph.D. in Mechanical Engineering). Such cooperation will significantly advance the interdisciplinary aspirations of the College. For example, faculty members in the computer engineering program have expressed the need for their doctoral students to learn about compilers so that they may test reconfigurable architectures that they develop. In addition, the Mechanical and Chemical Engineering Department is involved in projects to speed up radio-telescope phased ray data reduction and (in collaboration with Computer Science faculty) to produce more robust computational architectures for structural health monitoring.

The proposed degree program would have a traditional set of requirements, including course work, a qualifying examination, and a dissertation. A new student would choose or be assigned an advisor from among the tenure-track and tenured faculty in the Department. Students coming from other disciplines would be required to pass certain core courses at an appropriate level to guarantee general competence. A student would be

required to pass a qualifying examination administered after the first year of Ph.D.-level course work. Subsequently, the student would present a dissertation proposal to his/her doctoral committee in a preliminary examination. The committee would have five members, including the student's advisor and at least two other members of the Computer Science faculty; the remaining two members may be from other departments as appropriate given the dissertation topic. After passing the preliminary examination, the student may work on his/her dissertation. The Ph.D. degree would be awarded after the student successfully defended his/her dissertation before the committee.

Courses as well as qualifying examinations would be organized into three subject areas. A new student would choose an area in which to take his/her qualifying examination. Course work in an area would prepare the student for the qualifying examination in that area. The following are the envisioned areas, with subtopics indicated for each:

- Information security: wireless security, web security, access control, risk management, security architecture
- Distributed systems: web services, concurrency formalisms, distributed system design, visual analytics
- Artificial intelligence: computer vision, natural language processing, intelligent tutoring systems, and genetic, evolutionary and neural computing

The objectives of the proposed Ph.D. in Computer Science program would be

- to prepare educators and researchers capable of significant, globally-competitive research and high-level instruction in computer science,
- to provide higher education and research opportunities for computer scientists working with local industries as well as graduates from national and international institutions,
- to enhance the teaching and research capabilities of the Computer Science faculty through research-based interactions with industry, other universities and local, state, and federal government,
- to benefit the citizenry and economy of the State of North Carolina in general, and of the Piedmont Triad region in particular, by creating and nurturing research-based educational programs,
- to increase the number of African-American doctoral graduates in computer science ,
- to support programs that update high-school teachers in the STEM areas and that reach out to high-school students as well as to produce Ph.D. graduates who can effectively train high-school STEM teachers.

In the course of their professional development, graduates of the proposed Computer Science Ph.D. program should

- be able to conduct advanced research in such computer-science areas as information security, distributed systems, and artificial intelligence;
- be able to identify research problems in computer science and to develop solutions for them;
- be able to investigate and to develop solutions to important computing problems

from a variety of areas including business, the environment, our economy, healthcare, and law enforcement;

- appreciate the grand challenge problems in the discipline;
- develop into effective educators in computer science at the university level; and
- become leaders in the computer science community.

The proposed program will thus address, in whole or in part, all the major issues identified by the UNC Tomorrow Commission. It will also fulfill its responsibilities to the discipline of computer science and will attend in particular to the professional needs of its students.

### **UNC Tomorrow Relevance**

This proposed program fits primarily within UNC Tomorrow as a STEM program, but it includes the potential for engagement and economic development. Of note is the intention to provide attention to promoting K-12 science education.

### **Disciplinary Panel**

In addition to representatives from NCA&T, there were also representatives from ECU, UNCG and UNC-GA on the panel. Representatives of NCSU provided written comments as did UNC-CH. Representatives of the program presented an overview of the proposed doctoral program in computer science. They made the point that they have a very strong master's program in computer science having graduated approximately 300 students since the program started in 1993. There is a strong faculty available to form the core of the new doctoral program that have a strong record of publications and success in being funded from external sources. In recent years, grant funding for the department has averaged approximately \$9 million. Given the ability of NCA&T to draw a diverse student body, they expect to increase the number of African-Americans with doctorates in computer science in the country.

There was discussion of cloud computing and how that might fit into the program. Colleagues recognized that the publication and grant getting record was a strong one and would support doctoral level work.

### **Response**

There was some discussion of the difference between Computational Science and Engineering and the proposed new program in Computer Science. The focuses on information security, distributed systems, and artificial intelligence which are standard computer science areas would generally differentiate the two but the programs will engage in collaborative interdisciplinary work. Cloud computing will be encompassed in the work of the program.

### **Student Demand**

Their best evidence for student demand is the popularity of their master's degree in computer science. After the dot-com decline earlier in the decade interest in computer science declined even though there still was demand. Student interest is beginning to

grow again and NCA&T has the ability to draw a diverse population to their program. Opportunities in the field are there for the students who seek it.

### **Opportunities for Graduates of the Program**

The program has had good experience placing the master's graduates many of whom have gone into industry with major corporations. They provide evidence that there is a shortage of doctoral trained graduates so graduates of their program should have good opportunities nationally and regionally. The Bureau of Labor Statistics comments that "Graduates from Ph.D. programs in computer science and engineering are in high demand...." The diversity of the enrollment in computer science at NCA&T is a feature that attracts American industry.

### **Resource Implications**

The resource needs are typically specified more fully in the proposal for establishment. By the time the program is fully ramped up which would likely be at least six years from now, the estimated cost to be provided by State funding would be approximately \$460,000 dollars, or approximately \$92,000 per year over the five-year ramp up period.

### **Issues to Address in Planning**

As occurs with some program proposals, other campuses don't think the characterizations of their areas of focus are fully represented. It will be important to collaborate with other Computer Science Doctoral programs in the State as the proposal is fleshed out. The way cloud computing will be involved in the propose program needs to be given more attention.

### **Recommendation**

While there are two other doctoral programs in public universities in the State, the focuses of the program, the diversity of the student population attracted to graduate programs at NCA&T, and the great success of the research efforts in gaining grants funds provide a fertile context in which to develop another STEM doctoral program.

The staff of the General Administration recommends that the Committee on Educational Planning, Policies, and Programs approve the request from North Carolina A&T State University to plan a doctoral program in Computer Science.

**Approved to be Recommended for Planning to the Committee on Educational Planning, Policies, and Programs**



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Senior Vice President for Academic Affairs

August 2, 2010

### General Information Template for Academic Program Review

**Degree Area and Level:**

Ph.D. in Computer Science (CIP 11.0701) at NCA&T

**Addressing UNC Tomorrow:**

This proposed program would address several Recommendations within the UNC Tomorrow Report including the components to enhance Our Global Readiness (Recommendation 4.1), Our Citizens and Their Future: Access to Higher Education (Recommendation 4.2), Our Children and Their Future: Improving Public Education (Recommendation 4.3), Our Communities and Their Economic Transformation (Recommendation 4.4), and Our University's Outreach and Engagement (Recommendation 4.7).

**Role of Program in Relation to State and Regional Needs:**

According to the Bureau of Labor Statistics, "Computer scientists should enjoy excellent job prospects. Graduates from Ph.D. programs in computer science and engineering are in high demand, and many companies report difficulties finding sufficient numbers of these highly skilled workers. In addition to openings resulting from rapid growth in the occupation, some additional job openings will arise from the need to replace workers who move into other occupations or who leave the labor force."

Source: <http://www.bls.gov/oco/ocos304.htm>

**US Labor Department Analysis:**

- Summary and Summary Data – N/A

**Availability of Program Statewide (Enrollment and Degrees Awarded in Last 3 Years):**

- Public universities

Enrollment			Academic Year					
			Fall 06	Spr 07	Fall 07	Spr 08	Fall 08	Spr 09
NCSU	Computer Science	PhD	134	129	153	147	166	160
UNC-CH	Computer Science	PhD	107	103	111	106	130	126

Number of Degrees Awarded			Academic Year		
			2006-2007	2007-2008	2008-2009
NCSU	Computer Science	PhD	15	14	21
UNC-CH	Computer Science	PhD	14	7	16

- Private universities – Source: <http://gradschool.duke.edu/about/statistics/admitcomp.htm>

Enrollment			Academic Year			
			2006-2007	2007-2008	2008-2009	2009-2010
Duke University	Computer Science	PhD	72	75	63	65

Number of Degrees Awarded			Academic Year		
			2006-2007	2007-2008	2008-2009
Duke University	Computer Science	PhD	8	12	11

**Available in Online or Distance Format from UNC institutions:**

Not available

**Available or not from Academic Common Market:**

Not available

**NCA&T Campus enrollment and degrees awarded in similar programs at the Doctoral level:**

(Based on two CIP digits – 11 CIP is the summary group for Computer and Information Sciences and Support Services under which Computer Science is a program.) NCA&T does not offer any Doctoral programs in this CIP category.

**Campus Average of enrollment and degrees awarded in this degree area at the Doctoral level:**

(Based on two CIP digits – 11 CIP is the summary group for Computer and Information Sciences and Support Services under which Computer Science is a program - over the last 3 Academic Years, Fall 2006-Fall 2009)

Campus Average			
	Number of Active Programs	Enrollment per Semester	Degrees Awarded per Year
NCSU	1	148	17
UNCC	1	101	8
UNC-CH	1	114	12
Campus Average:		121	12

**NCA&T Campus Degree Programs added in the past three years:**

- *Bachelor*
  - BS Atmospheric Sciences and Meteorology (11/09/2007)
  - BS Bioengineering (06/11/2010)
- *Master*
  - MS Information Technology (09/07/2007)
  - MS Bioengineering (06/11/2010)
- *Doctoral*
  - Ph.D. Computational Science and Engineering (01/08/2010)

**NCA&T Degree Programs discontinued in past three years:**

- *Bachelor*
  - BS Visual Arts, Art Education (03/20/2009)
  - BS Music Education (03/20/2009)
  - BS Romance Languages and Literatures, French Secondary Education (03/20/2009)
  - BS Romance Languages and Literatures, Spanish Secondary Education (03/20/2009)
- *Master*
  - MS English Education (03/20/2009)
  - MS Mathematics Education (03/20/2009)
  - MS History Education (03/20/2009)
- *Doctoral*
  - N/A