PROPOSAL TO OFFER A NEW ACADEMIC PROGRAM/ MAJOR IN FALL 2005

(LONG FORM)

Proposed Name of Degree: **Master of Science in Computer Science**

Options/ Emphases in the Degree:

Faculty Proposing New Program: Peter Smith, William Wolfe, Geoff Dougherty, Ivona Grzegorczyk, Jorge Garcia, Jesse Elliott

Review and Approval:

1. Curriculum Committee Approval:

Curriculum Chair: _____ Date: _____

2. Academic Senate Approval:

Chair, Academic Senate: _____ Date: _____

3. Administration Approval:

President (or designee): _____ Date: _____

1. Definition of the Proposed Degree Major Program

a. Name of the campus submitting the request, the full and exact designation (degree terminology) for the proposed degree major program, and academic year of intended implementation.

California State University Channel Islands
Master of Science in Computer Science
Fall 2005

b. Name of the department, departments, division or other unit of the campus that would offer the proposed degree major program. Identify the unit that will have primary responsibility.

Computer Science Program

c. Name, title, and rank of the individual(s) primarily responsible for drafting the proposed degree major program.

Peter Smith, PhD
Professor of Computer Science

William Wolfe, PhD
Professor of Computer Science

Geoff Dougherty
Professor of Physics

Ivona Grzegorczyk, PhD
Professor of Mathematics

Objectives of the proposed degree major program.

General Objectives:
Provide students an opportunity to earn a Masters degree in Computer Science from the California State University.

Prepare students for employment in professional/high-technology industry, including software designer, scientific programmer, and programming analyst, with applications to the sciences, finance, business, education, military and local and federal government.

Prepare students for further study in graduate or professional schools.

Equip students with the analytical and programming skills that apply to variety of fields and offer various career opportunities, including consulting, scientific and technical positions in business and industry, research and development, national and industrial security or teaching positions.

Offer all CSUCI students the opportunity to broaden their knowledge and learn computational skills and computer technology that can be applied to various professional and personal situations.

Learning Objectives:

Students will:

Demonstrate critical thinking, problem solving, and advanced computational skills by identifying, evaluating, analyzing, synthesizing and presenting fundamental and advanced mathematical and computer science issues and their applications.

Demonstrate the knowledge of current computing practices and broad technology use in industry and education, including a working knowledge of software development techniques in various settings.

Be knowledgeable of emerging new technologies and industrial practices connected to the computer industry and demonstrate understanding of computing technologies in society.

Demonstrate cooperation skills by working effectively with others in interdisciplinary group settings – both inside and outside the classroom.

Demonstrate independent working and thinking skills by completing a graduate project and/or master thesis.

Demonstrate a sense of exploration that enables them to pursue rewarding careers in high-tech industries, bio-tech industries, finance, businesses, education systems, military and local and federal government

Demonstrate flexibility, transferability and adaptability of their life-learning skills that are so important n fast changing national and international economy.

Total number of units required for the major. List of all courses, by catalog number, title, and units of credit, to be specifically required for a major under the proposed degree program. Identify those new courses that are (1) needed to initiate the program and (2) needed during the first two years after implementation ~~(Complete Table 1)~~. Include proposed catalog descriptions of all new courses.

32 Semester units required for the major.

Since CSUCI will begin admitting graduate students in Fall 2005, all courses are new and will be needed to initiate the program. These courses will be offered during the first two years (and subsequent years) after program implementation. See the following pages for Courses and Catalog Descriptions.

CORE COURSES (11 Units)

COMP 510 Algorithms (3)
COMP 569 Artificial Intelligence (3)
Choose: One course from:
- MATH 510 Probabilistic Methods And Measure Theory (3)
- MATH 511 Functional Analysis (3)
- PHYS 510 Advanced Image Analysis Techniques (3)

Required: 2 units of:
- COMP 599 Graduate Seminar (1)

ELECTIVES (15 Units)

Choose 5 Electives, at least 3 courses in Computer Science, from the following list:

COMP	520	3	Advanced Database Systems
COMP	524	3	Security
COMP	529	3	Network Computing
COMP	549	3	Human-Computer Interaction
COMP	550	3	Object-Oriented Software Engineering
COMP	569	3	Artificial Intelligence
COMP	571	3	Biologically Inspired Computing
COMP	572	3	Neural Networks
COMP	575	3	Multi-Agent Systems
COMP	578	3	Data Mining
COMP/Math	581	3	Mathematical Methods in Artificial Intelligence
Math	511	3	Functional Analysis
Math	555	3	Actuarial Sciences
Math	565	3	Research in Mathematics Education
Math	582	3	Number Theory and Cryptography
Math	584	3	Algebraic Geometry and Coding Theory
Math	587	3	Markov Chains and Markov Processes
Math	588	3	Stochastic Analysis
PHYS	546	3	Pattern Recognition

PROJECT OR MASTER THESIS (6 units)

COMP 597 6 Master Thesis

TOTAL CREDITS: 32 units

COURSE DESCRIPTIONS FOR CATALOG

COMP 510 Algorithms (3)
Design strategies for algorithms and data structures. Theoretical limits to space and time requirements. Time/space trade-offs. Categories of problems and algorithms. Applications to business, bioinformatics, engineering, telecommunications and other disciplines. Open problems in the field.

COMP 520 Advanced Database Systems (3)
This graduate course covers advanced analysis of Relational Database Management Systems including their design and implementation. Topics include relational algebras, Entity Relation Diagrams, first, second, and third Normal Forms, data integrity constraints, triggers, query optimization, indexing, stored procedures, distributed databases, database administration issues, transaction processing and scheduling, object oriented database modeling, and data security

COMP 524 Security (3)
A survey of security issues and techniques for stand-alone and networked computer systems including databases. Techniques such as auditing, risk analysis, cost-benefit analysis. Security standards. Application in various fields.

COMP 529. Network Computing (3)
Design and programming of distributed systems that use telecommunication networks as their computing platform.

COMP 532 Computational Bioinformatics (3)
Contemporary computational models used in molecular biology and structures simulations will be introduced. Topics include dynamic programming, statistical/ information techniques for pattern recognition, algorithms for string alignments, structural superposition algorithms, computing with differential information, 3D motifs, Hidden Markov Models, phylogenetic trees, genetic algorithms.

Comp 549 Human-Computer Interaction (3)
The design, development and analysis of effective interfaces to computer systems. Trends in graphical user interfaces.

COMP 550. Object-Oriented Software Engineering (3)
Fundamentals of Object-Oriented Design and Analysis. Designing systems with Unified Modeling Language (UML) and patterns. Applications to other fields.

COMP 566. Geometry and Computer Graphics (3)
Algorithms for geometric analysis and retrieval of 3D shapes from large 3D databases common in several fields, including computer graphics, computer-aided design, molecular biology, paleontology, and medicine. The focus of study will be recent methods for matching, registering, recognizing, classifying, clustering, segmenting, and understanding 3D data.

COMP 569 Artificial Intelligence (3)
The course covers the many aspects of how human intelligence might be encoded in computer programs and mechanisms such as robots. This includes topics in Natural Language Processing, Computer Vision, Expert Systems, and Automated Problem Solving.

COMP 571 Biologically Inspired Computing (3)
Study of computing paradigms that have roots in Biology including Neuromorphic Systems, Evolutionary Systems, Genetic Programming, Swarm Intelligence and Artificial Immune Systems.

COMP 575. Multi-Agent Systems (3)
Fundamentals of modeling and analysis of multi-agent interaction systems, with multiple, competing, goals. Distributed processing concepts will be covered. Object-Oriented Design and Analysis

COMP 578 Data Mining (3)
This graduate course covers the fundamentals of Data Mining. This includes the analysis of patterns of data in large databases and data warehouses, the application of statistical pattern recognition, and data modeling and knowledge representation.

COMP/MATH 581. Mathematical Methods in Artificial Intelligence (3)
This course presents several branches of mathematics that provide computational basis for Artificial Intelligence. The course covers Trees and Search, The Concepts of Predicate Logic, The Theory of Resolution, Nonmonotonic Reasoning, Probability Theory, Bayesian Networks, Fuzziness and Belief Theory, Classifier Systems, Math for Neural Networks, Elements of Statistics, Decision Trees and Optimization.

COMP 572 Neural Networks (3)
Covers the basic ideas of distributed computation with many simple processing units, similar to the neurons of the brain. Topics include: Hopfield style networks applied to optimization problems, and the backpropagation method applied to pattern classification problems. Additional topics include associate memory, binary vs analog networks, simulated annealing.

Comp 597 Master Thesis (1-6)
Supervised research in the field of computer science or its applications. All students are required to present their research at Graduate Seminar and write Master Thesis. Repeatable.

COMP 599 Graduate Seminar (1)
Oral presentations of current advancements in the field, reports on students' research, master thesis, and projects. Repeatable.

Math 510 Probabilistic Methods And Measure Theory. (3)

Three hours of lecture in the lab per week.
Introduction to probabilistic methods. Topic include: sigma algebras, measures, integrals, Lebesgue measure, main convergence results and the change of variable results for integrals. Probabilistic methods in computational sciences are studied.

Math 511 Functional Analysis (3)
Three hours of lecture per week.
Metric spaces, function spaces, normed vector spaces, linear operators. Banach spaces, Hilbert spaces. Spectral theory. Fundamental theorems in functional analysis. Applications in various fields including computer science, bioinformatics, statistical analysis.

Math 555 Actuarial Sciences (3)
Three hours of lecture.
The course provides a sound grounding in the mathematical, statistical and financial concepts needed for actuarial work, including technical and communication skills. Probability, statistics, data analysis, mathematical modeling. Risk analysis, pension plans, financial economics, time series.Various software packages are used.

Math 565 Research in Mathematics Education (3)
Three hours of lecture per week,
Mathematical research methods in education. Current issues of college level curriculum including systems of geometry, algebra, precalculus, calculus, probability and statistics, linear algebra, differential equations, and discrete mathematics.

MATH 482. Number Theory and Cryptography (3)
Three hours of lecture per week.
Number theory, finite fields, polynomial rings, elliptic curves, public-key cryptography, zero-knowledge protocols, primality testing, factorization algorithms and applications.

Math 584 Algebraic Geometry and Coding Theory (3)
Three hours of lecture per week.
Algebraic varieties over algebraically closed fields and finite fields, Hamming codes, cyclic codes, BCH codes, alternant codes, Goppa codes, codes on graphs.

Math 587 Markov Chains and Markov Processes (3)
Three hours of lecture.
Topics include: Central Limit Theorem, Law of Large Numbers, Convergence Theorems, Markov Chains and Markov Processes. Applications in other fields, such as bioinformatics and computer science.

Math 588 Stochastic Analysis (3)
Three hours of lecture.
Topics include: Brownian motion, stochastic integrals, conditional expectation, Kolmogorv's Theorem, applications of Lebesgue Dominated Convergence Theorem. Introduction to Stochastic Differential Equations will be given.

PHYS 510 Advanced Image Analysis Techniques (3)
Three hours of lecture in the lab per week.
Image processing course in the fundamentals of 2-D digital signal processing with emphasis in image processing techniques, image filtering design and applications. Programming exercises in Matlab (or Octave) will be used to implement the various processes, and their performance on synthetic and real images will be studied. Applications in medicine, robotics, consumer electronics and communications.

PHYS 546 Pattern Recognition (3)
Three hours of lecture in the lab per week.
New and emerging applications of pattern recognition - such as data mining, web searching, multimedia data retrieval, face recognition, and cursive handwriting recognition - require robust and efficient pattern recognition techniques. Statistical decision making and estimation are regarded as fundamental to the study of pattern recognition. The course addresses the issue of analyzing pattern content by feature extraction and classification. The principles and concepts underpinning pattern recognition, and the evolution, utility and limitations of various techniques (including neural networks) will be studied. Programming exercises will be used to implement examples and applications of pattern recognition processes, and their performance on a variety of diverse examples will be studied.

f. List of elective courses, by catalog number, title, and units of credit that can be used to satisfy requirements for the major. Identify those new courses that are (1) needed to initiate the program and (2) needed during the first two years after implementation ~~(Complete Table 1)~~. Include proposed catalog descriptions of all new courses.

Since CSUCI will begin admitting graduate students in Fall 2005, all courses are new and will be needed to initiate the program. MS students are required to complete 15 units of electives from the following list.

COMP	520	3	Advanced Database Systems
COMP	524	3	Security
COMP	529	3	Network Computing
COMP	549	3	Human-Computer Interaction
COMP	550	3	Object-Oriented Software Engineering
COMP	569	3	Artificial Intelligence_
COMP	571	3	Biologically Inspired Computing
COMP	572	3	Neural Networks
COMP	575	3	Multi-Agent Systems
COMP	578	3	Data Mining
COMP/Math	581	3	Mathematical Methods in Artificial Intelligence
Math	511	3	Functional Analysis
Math	555	3	Actuarial Sciences

Math	565	3	Research in Mathematics Education
Math	582	3	Number Theory and Cryptography
Math	584	3	Algebraic Geometry and Coding Theory
Math	587	3	Markov Chains and Markov Processes
Math	588	3	Stochastic Analysis
PHYS	546	3	Pattern Recognition

COURSE DESCRIPTIONS FOR CATALOG

See above descriptions

g. If any formal options, concentrations, or special emphases are planned under the proposed major, explain fully.

This Masters Program in Computer Science emphasizes close connections between Computer Science and Mathematics. The "emphasis" is on breadth of knowledge in computer science and mathematics, with the aim of preparing students for a wide range of possible industry, academic, and research positions.

h. Course prerequisites and other criteria for admission of students to the proposed degree major program, and for their continuation in it.

Admission: Students seeking admission are expected to have an undergraduate degree in Computer Science or an undergraduate degree in Mathematics with an emphasis in computer science. Students with undergraduate degrees in closely related areas, such as Engineering and the Sciences, will be considered on a case by case basis and may be provisionally accepted. The applicant is expected to have a 2.7 or higher cumulative undergraduate gpa, and to submit 3 letters of recommendation. Students with cumulative undergraduate gpa less than 3.0 must also submit GRE scores. Students must remain in good academic standing, with at least a B- average in their graduate work.

List of Courses with Prerequisites – This MS CS program is "flat" in that all of the initial courses will not require other graduate course. As a general rule of thumb, a student is expected to have had an undergraduate course in the same area as any graduate course they choose to take, or have permission of the instructor. As this MS CS Program matures advanced courses will be added that require a prerequisite graduate course.

Math	510	3	Probabilistic Methods And Measure Theory
COMP	510	3	Algorithms (3)
PHYS	510	3	Advanced Image Analysis Techniques (3)
COMP	520	3	Advanced Database Systems
COMP	524	3	Security
COMP	529	3	Network Computing
COMP	549	3	Human-Computer Interaction
COMP	550	3	Object-Oriented Software Engineering

COMP	569	3	Artificial Intelligence
COMP	571	3	Biologically Inspired Computing
COMP	572	3	Neural Networks
COMP	575	3	Multi-Agent Systems
COMP	578	3	Data Mining
COMP/Math	581	3	Mathematical Methods in Artificial Intelligence
Math	511	3	Functional Analysis
Math	555	3	Actuarial Sciences
Math	565	3	Research in Mathematics Education
Math	582	3	Number Theory and Cryptography
Math	584	3	Algebraic Geometry and Coding Theory
Math	587	3	Markov Chains and Markov Processes
Math	588	3	Stochastic Analysis
PHYS	546	3	Pattern Recognition
COMP	597	1-6	Master Thesis
COMP	599	1	Graduate Seminar

i. Explanation of special characteristics of the proposed degree major program, e.g., in terminology, units of credit required, types of course work, etc.

This Masters Program in Computer Science will have a tighter connection with the mathematics program than most equivalent programs in the CSU. This degree program is intended to foster a strong relationship between the computer skills typical of a traditional MS in CS and the analytical skills typical of a higher degree in mathematics. It will also encourage a strong interaction between Mathematics and Computer Science faculty. As a result, there will be a lot of overlap and interaction between graduate mathematics and graduate computer science students.

The program will leverage local industry to provide high tech projects and internships. (We have good relationships with several companies, and our undergraduate students are already placed in internship positions).

j. For undergraduate programs, provisions for articulation of the proposed major with community college programs.

N/A

k. Provision for meeting accreditation requirements, where applicable, and anticipated date of accreditation request.

The program is designed in accordance with the major accrediting body ABET:

Accreditation Board for Engineering and Technology, Inc.
111 Market Pl., Suite 1050
Baltimore, MD 21202

(410) 347-7700
(410) 625-2238 (Fax)

2. Need for the Proposed Degree Major Program

a. List of other California State University campuses currently offering or projecting the proposed degree major program; list of neighboring institutions, public and private, currently offering the proposed degree major program.

Most other CSU campuses offer a Master of Science in Computer Science, as well as most local universities such as CLU, UCSB, and Pepperdine. However, the demand for graduate work in computer science is very high in our region. For example, students working at the Point Mugu and Port Hueneme Military bases have to travel to CSU Northridge or UCSB to get an equivalent program. It is worth noting that CSUN's computer science program is currently "impacted", so they are not planning to accommodate student demand.

b. Differences between the proposed program and programs listed in Section 2a above.

Our Masters Program in Computer Science will have a tighter connection with the mathematics program than most equivalent programs in the CSU. This degree program is intended to foster a strong relationship between the computer skills typical of a traditional MS in CS and the analytical skills typical of a higher degree in mathematics. It will also encourage a strong interaction between Mathematics and Computer Science faculty. As a result, there will be a lot of overlap and interaction between graduate mathematics and graduate computer science students.

The program will leverage local industry to provide high tech projects and internships. (We have good relationships with several companies, and our undergraduate students are already placed in internship positions).

f. Professional uses of the proposed degree major program.

The Master of Science in Computer Science will prepare students for a variety of high-tech industrial positions. The Degree would also prepare students for further graduate education in computer related fields.

g. The expected number of majors in the year of initiation and three years and five years thereafter. The expected number of graduates in the year of initiation and three years and five years thereafter.

	Number of Majors*	Number of Graduates*
Initiation Year	20	0
Third year	40	30
Fifth year	100	80

* from CSU Channel Islands Enrollments Models

3. Existing Support Resources for the Proposed Degree Major Program

Faculty members, with rank, appointment status, highest degree earned, date and field of highest degree, and professional experience (including publications if the proposal is for a graduate degree), who would teach in the program.

BRIEF FACULTY BIOGRAPHIES (up to 3 relevant publications listed).

Ivona Grzegorczyk
Professor of Mathematics
PhD in Mathematics, UC Berkeley, 1990
Mathematics Professor since 1990
Extensive experience in the areas of algebraic geometry, moduli problems, applied mathematics, mathematics education.

Selected publications:
1. On Newstead's Conjecture on Vector Bundles on Algebraic Curves, Mathematichen Annallen 300, 521-541(1994).
Mathematics and Fine Arts, Kendall/Hunt publishing Co., (2000) .
3. Geography of Brill-Noether Loci for Small Slopes (with L. Brambila-Paz and P. Newstead), Journal of Algebraic Geometry. 6 (1997).

Peter Smith
Professor of Computer Science
PhD in Computer Studies, Lancaster University, 1975
Computer Science Professor since 1980
Extensive experience in the areas of data structures and algorithms

Selected publications:
1. Applied Data Structures with C++ , Jones and Bartlett, 2004
2. Experiments with word-by-word compression of English text using lexicons, Computer Journal, 1992.
3. Experiments with a very fast substring search algorithm, Software-Practice and Experience, 1991.

William Wolfe

Professor of Computer Science
PhD in Mathematics, CUNY, 1976
Computer Science Professor since 1988
Extensive experience in Neural Networks, Artificial Intelligence, Databases.

Selected publications:
Student Peer Reviews in an Upper Division Mathematics Class, Exchanges: The Online Journal of Teaching and Learning in the CSU, September
Thee Scheduling Algorithms Applied to the Earth Observing Systems Domain INFORMS Journal on Management Science, Vol. 46, No. 1, January 2000 pp. 148-
A Fuzzy Hopfield-Tank TSP Model INFORMS Journal on Computing, Vol. 11, No. 4, Fall 1999 pp. 329-

Geoffrey Dougherty
Professor of Physics
Ph.D. in Biophysics, University of Keele, 1979
Medical Imaging/Physics Professor since 1986
Extensive experience in medical imaging, image analysis, and bioengineering.

Selected publications:
Dougherty, G and Henebry, G. Lacunarity analysis of spatial pattern in CT images of vertebral bone for assessing osteoporosis. Med. Eng. Phys., 2002, 24, 129-138.
Dougherty, G. and Kawaf Z. The point spread function revisited: image restoration using 2-D convolution. Radiography, 2001, 7, 255-262.
3. Dougherty, G. and Henebry, G. Fractal signature and lacunarity in the measurement of the texture of trabecular bone in clinical CT images. Med. Eng. Phys., 2001, 23, 369-380.

Jesse Elliot
Assistant Professor of Mathematics
PhD in Mathematics, UC Berkeley, 2003
Mathematics Professor since 2003
Experience in commutative algebra and number theory.

Selected publications:
Witt-Burnside Rings (dissertation), UC Berkeley, 2003
Binomial Rings (preprint on website)

Jorge Garcia
Assistant Professor of Mathematics
PhD in Mathematics, U-W Madison, 2002
Mathematics Professor since 2002
Extensive experience in Stochastic Processes, Large Deviations, Stochastic Integrals, Probability, Markov Processes and Measure Theory.

Selected publications:

An Extension of the Contraction Principle, Journal of Theoretical Probability, October, 2003 A Large Deviation Principle for Stochastic Integrals (In Preparation)

4. Additional Support Resources Required

b. Any special characteristics of the additional faculty or staff support positions needed to implement the proposed program.

This Masters Program in Computer Science will be offered by the Office of Extended Education, so the hiring of additional faculty to support this program, as well as other resources, will be negotiated through that office.

c. The amount of additional lecture and/or laboratory space required to initiate and sustain the program over the next five years. Indicate any additional special facilities that will be required. If the space is under construction, what is the projected occupancy date? If the space is planned, indicate campus-wide priority of the facility, capital outlay program priority, and projected date of occupancy.

As a self-support program, additional labs and classroom space will be paid for and managed by the Office of Extended Education.

d. Additional library resources needed. Indicate the commitment of the campus to purchase or borrow through interlibrary loan these additional resources.

If there are any library support services necessary (at the moment there are no plans) they will be paid for by the Office of Extended Education.

e. Additional equipment or specialized materials that will be (1) needed to implement the program and (2) needed during the first two years after initiation. Indicate the source of funds and priority to secure these resource needs.

No new needs beyond those planned during the development of the campus facilities and funded by the Office of Extended Education.

5. Abstract of the Proposal and Proposed Catalog Description

MASTER OF SCIENCE COMPUTER SCIENCE

Contact person: William J. Wolfe, Professor of Computer Science
Phone: (805) 437-8985 Fax: (805) 437-8864
Web Page: http://www.csuci.edu

Email: william.wolfe@csuci.edu

DEGREE OFFERED:
Master of Science in Computer Science

THE PROGRAM: The MS in Computer Science degree at Channel Islands offers latest, cutting edge education in computer science. The program will prepare students for careers as computer professionals in high-tech industries, businesses, education systems, military and local and federal government, where interdisciplinary, dynamic and innovative professionals trained in latest computer technologies are increasingly sought. Students will be obtain a strong background in mathematics, computer hardware and software, as well as skills to conduct independent applied research or develop an industrial project. The program will stress interdisciplinary applications, especially the interaction between Mathematics and Computer Science.

CORE COURSES (11 Units)

COMP 510 Algorithms (3)
COMP 569 Artificial Intelligence (3)
Choose: One course from:
- MATH 510 Probabilistic Methods And Measure Theory (3)
- MATH 511 Functional Analysis (3)
- PHYS 510 Advanced Image Analysis Techniques (3)

Required: 2 units of:
- COMP 599 Graduate Seminar (1)

ELECTIVES (15 Units)

Choose 5 Electives, at least 3 in Computer Science, from the following list,

COMP	520	3	Advanced Database Systems
COMP	524	3	Security
COMP	529	3	Network Computing
COMP	549	3	Human-Computer Interaction
COMP	550	3	Object-Oriented Software Engineering
COMP	569	3	Artificial Intelligence
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Math	587	3	Markov Chains and Markov Processes
Math	588	3	Stochastic Analysis
PHYS	546	3	Pattern Recognition

PROJECT OR MASTER THESIS (6 units)

COMP 597	6	Master Thesis

TOTAL CREDITS: 32 units