Fast Track
General Education Foundations Course Articulation
From a UH Campus to UH M~noa: PROPOSAL FORM, INFO. & COMPUTER SCIENCE

Course Information

Course: ICS 141
Submitting Campus: Kapi'olani Community College

Title & Catalog Description:
Logic, sets, functions, matrices, algorithmic concepts, mathematical reasoning, counting techniques, probability theory, relations, equivalences, partial orders, basic graphs, and tree concepts.

PREQ: Credit or concurrent enrollment in ICS 111; credit or concurrent enrollment in MATH 205

UHM Equivalent Course (check one): [Only equivalent courses may be submitted for Fast Track review.]

X ICS 141 Discrete Mathematics for Computer Science I, Symbolic Reasoning
ICS 241 Discrete Mathematics for Computer Science II, Symbolic Reasoning

Symbolic Reasoning (FS) Hallmarks & Application Questions

Answer the following questions and submit the answers along with this form and at least one course syllabus.

1. Students will be exposed to the beauty, power, clarity and precision of formal systems. How will the course meet this hallmark?
2. Instructors will help students understand the concept of proof as a chain of inferences. How will instructors help students understand this concept?
3. Instructors will teach students how to apply formal rules or algorithms. How will instructors meet this hallmark?
4. Students will be required to use appropriate symbolic techniques in the context of problem solving, and in the presentation and critical evaluation of evidence. What symbolic techniques will be required and in what contexts? How will presentations and evaluations of evidence be incorporated into the course?
5. The course will not focus solely on computational skills. What reasoning skills will be taught in the course?
6. Instructors will build a bridge from theory to practice and show students how to traverse this bridge. How will instructors help students make connections between theory and practice?

Required Signatures

Requested by ____________________________
Alfred Seita
Chair/Director

Business Education
Department/Unit

Signature ____________________________ Date ____________

Approved by ____________________________
Chief Academic Officer

Campus

Signature ____________________________ Date ____________

Submit to vpaa-gened@hawaii.edu by 4:00 p.m., February 5, 2003.
Foundations Hallmarks and Application Questions: SYMBOLIC REASONING

1. Students will be exposed to the beauty, power, clarity and precision of formal systems.  
   *How will the course meet this hallmark?*

   The breadth of material includes many of the major topics of mathematics and computer science theory. They include logic, Sets, Functions, Matrices, Mathematical reasoning, Counting techniques, Equivalence Relations, and Partial ordering.  ICS faculty will introduce applications of these topics to everyday problems. These application examples are carefully selected to expose the beauty, power, clarity and precision of formal computational systems. In addition, the homework exercises are specifically selected to show students the power and precision of these computational systems.

2. Instructors will help students understand the concept of a proof as a chain of inferences.  
   *How will instructors help students understand this concept?*

   There are two ways that we address this issue. In the first case, we formally cover the logical foundations of mathematical reasoning including the concepts of axioms, rules of inference, lemmas, theorems, and corollaries.  We expose students to the various tautologies of addition, simplification, and classical formal methods of proofs including modus ponens, modus tollens, hypothetical syllogism, and disjunctive syllogism, and include direct and indirect proofs and proof by contradiction.  In the second case we introduce new theorems in mathematics by going through examples of their usage, then analyzing the fundamental principles is a very effective way of getting students to appreciate the concept of a proof as a chain of inferences. This kind of activity is carried out in all parts of the course.

3. Instructors will teach students how to apply formal rules of algorithms.  
   *How will instructors meet this hallmark?*

   A major focus of this course is to expose students to the practical usage of mathematics. Students are required to solve significant number of problems for homework assignments and in-class exams. An inherent part of this effort is to apply formal rules of logic and to apply algorithmic computations to the problem solving process. In elementary number theory we introduce the concept of congruences and ask students to relate this concept to examples like the representation of numbers in different bases, the use of bar codes in supermarkets, and their usage in ISBN codes to uniquely identify books.

4. Students will be required to use appropriate symbolic techniques in the context of problem solving, and in the presentation and critical evaluation of evidence  
   *What symbolic techniques will be required and in what contexts? How will presentations and evaluations of evidence be incorporated into the course?*

   Symbolic techniques are most prominent in the logic, sets, relations, equivalences, and graphs portion of the course. In logic, they are used to represent lemmas, theorems, and corollaries and the results of the use of rules of the inference on them. In set theory they are used to represent sets and the results of basic operations on sets. In graph theory symbolic techniques are used to represent graphs and the results of basic graph oriented operations on them. In Boolean logic students are asked to design logic circuits that perform specific logical and computational functions such as addition.

5. The course will not focus solely on computational skills.  
   *What reasoning skills will be taught in the course?*

   In the logic and mathematical reasoning portion of the course the emphasis will be on proof techniques as a reasoning skill. Students will be exposed to the idea of a rigorous argument to support a concept.
COURSE: ICS141 DISCRETE MATHEMATICS FOR COMPUTER SCIENCE     31492
TR 12:15pm – 1:30pm
INSTRUCTOR: Mrs. Anne Niethammer     a.niethammer@worldnet.att.net
OFFICE: KOPIKO 114
OFFICE HOURS: After class and by appointment

and Student Solutions Guide
Kenneth H. Rosen
McGraw-Hill Inc.

PREREQUISITES: Credit or concurrent enrollment in ICS111
Credit or concurrent enrollment in MATH 205

COURSE OBJECTIVES: This course is designed to introduce the student to the fundamental areas of discrete mathematics that have applications in computer science. The goal is to teach the student to think mathematically by stressing mathematical reasoning and to explore the different ways problems are solved.

Upon successful completion of ICS141 the student should be able to:

1. Solve problems in propositional logic, work with truth tables and use Venn diagrams.
2. Solve problems in elementary set theory.
3. Understand the concept of algorithms and the power of using various types of algorithms to solve problems.
4. Use mathematical induction to prove theorems.
5. Use the formulas for permutations, combinations and binomial coefficients.
6. Understand the concept of recursion and solve simple problems using recursion.
7. Understand relation, graph and tree terminology.

HOMEWORK:
Homework will consist of reading and chapter exercises in the text book(s). Homework turned in after the due date will be considered late. If you are unable to attend class, please arrange to turn in your assignments before class. Late homework will be penalized 10% for each class day late after the due date. Assignments will be logged in when I receive them. Incomplete homework or homework with many errors will be returned to be completed for half credit. Assignments submitted after seven days will be checked off as completed with zero points.

EXAMINATIONS AND QUIZZES:
There will be regularly scheduled examinations and may be announced and/or unannounced quizzes. Scheduled examinations are listed on your course syllabus and are to be taken on the dates scheduled. Do not schedule routine medical or other appointments on examination days.

CLASS POLICIES AND STUDENT RESPONSIBILITIES, OUR PARTNERSHIP:

1. Lecture will begin promptly; please do not be late to class. Latecomers will be counted absent. Computers will remain OFF during lecture time. NO FOOD OR BEVERAGES IN THE CLASSROOM. Turn off all beepers and cell phones while in class.

2. Regular attendance is required and is defined as no more than three unexcused absences. Excessive absences may cause your grade to be lowered regardless of your class average. Students who fail to attend class and do not officially withdraw will receive a grade of F. Please check the KCC catalog for withdrawal dates.

3. No makeup exams or quizzes will be given. Extra credit assignments will not be given. No incomplete will be given for missing examinations or assignments.

4. Cheating will not be accepted. Cheating on exams will be either giving or receiving aid. Do not copy or share written or project assignments. Any homework that is exchanged or copied will receive a grade of zero.
5. Reading assignments will be given throughout the course; please complete all reading assignments before coming to class and be prepared to consult other sources and texts in the library.

6. The order and subject matter as outlined in the syllabus may be altered during the course.

GRADING:
Quizzes, examinations and homework will have an associated point count.
Examinations: listed on syllabus (4) \( \frac{100}{4} \) points
Homework/unscheduled activities \( \frac{100}{200} \) points

A (180 - 200) Outstanding scholarship, excellent achievement  
B (160 - 179) Superior work, above average achievement  
C (140 - 159) Average achievement indicating a competent grasp of subject matter  
D (120 - 139) Inferior work, minimal passing achievement  
F (below 120) Failure

STUDENT RECORD OF CLASS PERFORMANCE:
Maintaining an accurate record of your grades is your responsibility. After each assignment is returned to you, record your points in the appropriate space. To compute your current average at any time, use one of the CHECKPOINTS spaces below. Divide your cumulative points by the total possible number of points to date. This gives you your current class average. Space is provided below for this purpose.

<table>
<thead>
<tr>
<th>Homework/ Assignments</th>
<th>Examinations</th>
<th>Checkpoints</th>
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<tbody>
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Student notes:
<table>
<thead>
<tr>
<th>WEEK</th>
<th>DATE</th>
<th>ASSIGNMENT-ACTIVITY</th>
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<tbody>
<tr>
<td>1</td>
<td>8/25</td>
<td>1.1-1.2 Logic, Propositional Equivalences</td>
</tr>
<tr>
<td>2</td>
<td>9/1</td>
<td>1.3-1.5 Predicates and Quantifiers, Sets</td>
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<tr>
<td>3</td>
<td>9/8</td>
<td>1.6-1.8 Functions, Sequences and Summations</td>
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<td><strong>CHAPTER 2 - THE FUNDAMENTALS: Algorithms, the Integers, and Matrices</strong></td>
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<tr>
<td>4</td>
<td>9/15</td>
<td>2.1-2.4 Algorithms, Integers, Division and Algorithms</td>
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<td>5</td>
<td>9/22</td>
<td>2.5-2.6 Applications of Number Theory, Matrices</td>
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<td><strong>EXAMINATION 1 – SEPTEMBER 25TH</strong></td>
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<td>6</td>
<td>9/29</td>
<td>3.1-3.3 Methods of Proof, Induction and Recursion</td>
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<td>7</td>
<td>10/6</td>
<td>3.4-3.5 Recursive Algorithms</td>
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<td><strong>CHAPTER 3 - MATHEMATICAL REASONING</strong></td>
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<tr>
<td>8</td>
<td>10/13</td>
<td>4.1-4.2 The Basics of Counting</td>
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<tr>
<td>9</td>
<td>10/20</td>
<td>4.3 Permutations and Combinations</td>
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<tr>
<td>10</td>
<td>10/27</td>
<td>4.4-4.5 Probability</td>
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<td><strong>Examination 2 – Wednesday, October 30th</strong></td>
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<td>11</td>
<td>11/3</td>
<td>4.6-4.7 Additional topics, Permutations and Combinations</td>
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<td><strong>CHAPTER 4 - COUNTING</strong></td>
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<tr>
<td>12</td>
<td>11/10</td>
<td>5.1 Recursive Relations</td>
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<tr>
<td>13</td>
<td>11/17</td>
<td>5.2-5.3 Solutions/Divide-and-Conquer</td>
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<td>14</td>
<td>11/24</td>
<td>6.1 – 6.3 Relations</td>
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<td>15</td>
<td>12/1</td>
<td>7.1 – 7.3</td>
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<td>16</td>
<td>12/8</td>
<td>8.1 – 8.4 Trees</td>
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<td><strong>Review for Final Examination</strong></td>
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<td><strong>Final Examination – Wednesday, December 18th 7:45am</strong></td>
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ICS 141 Discrete Mathematics for Computer Science I

1. COURSE DESCRIPTION:  

ICS 141 Discrete Mathematics for Computer Science I (3)  
3 hours lecture per week  
Prerequisite: ICS 111 or Concurrent Enrollment; MATH 205 or Concurrent Enrollment in MATH 205

This course covers logic, sets, functions, matrices, algorithmic concepts, mathematical reasoning, counting techniques, probability theory, relations, equivalences, partial orders, basic graphs, and tree concepts.

2. COURSE OBJECTIVES/COMPETENCIES:

Upon successful completion of ICS 141, the student should be able to:

... Solve problems in propositional logic, work with truth tables, and use Venn diagrams.

... Solve problems in elementary set theory.

... Prove theorems using mathematical induction.

... Use the formulas for permutations, combinations, and binomial coefficients.

... Some elementary problems of relations, equivalences, and partial order.

... Understand graph terminology.

... Understand tree terminology.

3. GENERAL EDUCATION AND RELATIONSHIP TO OTHER COURSES:

ICS 141 is a required course in the Pre-Information and Computer Science Advising Program curriculum. It is a pre-requisite course for ICS 241 which is required for UH Manoa's Bachelor of Science and Bachelor of Arts Curricular in ICS. This course along with ICS 241 provides the formal mathematical foundations for the development and implementation of algorithms required to solve problems in computer science. ICS 141 requires a student to have a thorough understanding of all math prior to calculus. The pre-requisite of Math 205 or the concurrent enrollment in Math 205 or the consent of the instructor is necessary for the success of the student in ICS 141. A level of maturity in mathematics is an indication of success in the course. Those students who have successfully completed Math 205 or have taken Math 205 concurrently have the best chance of succeeding.

This course supports the following college competency areas:

... computation and communication abilities
... problem-solving and decision-making abilities

... career choices and life-long learning

... study in a selected program

This course also satisfies the following Associate in Art degree competencies:

... Employ those skills in communication, mathematics and historical content essential to further college work.

... Demonstrate, by completion of elective and/or required courses the educational background necessary for more specific professional and personal goals.

... Make a decision if desired about further course of study in a four-year college, with a capacity to declare a major and select courses directed toward that major, based upon a realistic assessment of personal needs and aspirations.

Critical thinking, an analytical and creative process, is essential to every content area and discipline. It is an integral part of information retrieval and technology, oral communication, quantitative reasoning, and written communication. Upon completion of an A.A. degree, the student should be able to:

... Apply problem-solving techniques and skills, including the rules of logic and logical sequence.

... Communicate clearly and concisely the methods and results of logical reasoning.

Information retrieval and technology are integral parts of every content area and discipline. Upon completion of an A.A. degree, the student should be able to:

... Recognize, identify, and define an information need.

Quantitative reasoning can have applications in all content areas and disciplines. Upon completion of an A.A. degree, the student should be able to:

... Apply numeric, graphic, and symbolic skills and other forms of quantitative reasoning accurately and appropriately.

... Demonstrate mastery of mathematical concepts, skills, and applications, using technology when appropriate.

... Formulate and test hypotheses using numerical experimentation.

ICS 241 satisfies the following Associate in Art degree requirements:

... Reason mathematically and understand mathematical concepts.

... Apply mathematical reasoning and concepts in a study of the relationship of mathematics to the modern world.
4. COURSE CONTENT:

14% The logical foundations: logic, propositional equivalences, predicates and quantifiers, sets and set operations, functions, sequences and summations, and the growth of functions.

10% The fundamentals of algorithms: algorithms and the complexity of algorithms.

10% Integers and Matrices: integers and division, applications of number theory, round off in computers, and matrices.

14% Mathematical reasoning: methods of proof and mathematical induction.

14% Counting techniques: the basics of counting and the pigeonhole principle, permutations and combinations.

14% Relations, equivalences, and partial orders: relations and their properties, n-ary relations and their applications, representing relations, closure of relations, equivalence relations, partial orderings.

12% Graph concepts: introduction and terminology.

12% Tree concepts: introduction to tree.

5. POSSIBLE TEXTS:


In addition to the text, student are expected to purchase several high-density 3 1/2 inch floppy disks.

6. REFERENCE MATERIALS:

A number of textbooks dealing with discrete mathematics are available at U.H. Manoa's Hamilton Library. A limited but sufficient number of textbooks are also available at KCC's Library.

7. AUXILIARY MATERIALS AND CONTENT:

Use is made of an instructor presentation computer with LCD projector to demonstrate mathematical concepts and program activities too complex for a purely verbal description. Overhead transparencies, slides, films, and other media may also be used to supplement the lecture method of presentation.
Several class sessions may be scheduled in the Business Education instructional labs for demonstrations and "hands on" activities to step the students through an activity that is highly specific to the machine and software.

8. METHODS OF INSTRUCTION:

The lecture method will be used primarily. Students will be assigned homework to help them understand the material. Exams and quizzes will be given appropriately throughout the semester.

Classroom activities in this course will include:

Lectures - Instructor presents concepts/material to the student.

Discussions - Instructor answers questions, explains and clarifies previously covered material, and encourages student participation.

Demonstrations - Instructor will use appropriate computer-aided instruction to demonstrate mathematical concepts during lecture.

Homework - Instructor provides outside assignments to demonstrate and reinforce material covered in the lectures. Students are to accomplish homework outside of class time.

Review - Instructor emphasizes important points of previously covered material and recommends study methods and materials.

9. METHOD OF EVALUATION:

The following represents the anticipated weight of the various graded activities of the course:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Examinations</td>
<td>60%</td>
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<tr>
<td>Homework</td>
<td>30%</td>
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<tr>
<td>Quizzes</td>
<td>10%</td>
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</table>

Course 100%

The letter grade awarded as the final measure of student achievement in the course will be based upon the following percentages:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>A</td>
<td>90 - 100%</td>
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<tr>
<td>B</td>
<td>80 - 89%</td>
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<tr>
<td>C</td>
<td>70 - 79%</td>
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<tr>
<td>D</td>
<td>60 - 69%</td>
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<tr>
<td>F</td>
<td>0 - 59%</td>
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10. JUSTIFICATION:

A. ICS 141 is not a new course. The curriculum submitted is to update the contents of the course. This curriculum change is required to articulate with the changes that have been implemented by the ICS Department at U.H. Manoa.
B. ICS 141 is not an experimental course.

C. ICS 141 will neither increase nor decrease the number of required hours needed for a certificate or degree.

11. RESOURCE REQUIREMENTS:

A. This is not a new course; therefore, it will not require any change in staff, equipment, facilities, nor other resources.

B. This course will not impact on other departments. The IT/ICS programs will manage the classroom and office resources internally.

C. Course enrollment is estimated to be twenty-four students per semester. One section will be offered each semester.

12. ARTICULATION:

A. This course is offered with three credit hours at UH Manoa (ICS 141), UH Hilo (CS 215), Honolulu Community College (ICS 141), Leeward Community College (ICS 141), and Maui Community College (ICS 215).

B. This course is appropriate for articulation with the ICS Department at UH Manoa, CS Department at UH Hilo, Honolulu Community College, Leeward Community College, and Maui Community College.