Mathematical Sciences Division Curriculum Committee
Agenda
February 3, 2015

Completed: We will be voting!

- Math 210 – 1 unit added to comply with C-ID, it is listed as a Math Course, but complies with the Computer Science C-ID
- Math 190 – L'Hopital's Rule needed to be explicitly stated as a topic. It is currently being taught in this class.

Still to Come:

MATH

Since deactivating Math 25, the following courses need to be updated to remove Math 25 as the Prerequisite course:

- Math 33
- Math 40
- Math 67

ENGINEERING:

- ENGR-1 – Due for a course review, possibly cross list it so that we can find an instructor easily.
- Engr 10 – Circuits – would like to offer a circuits class for Engineering students.

COMPUTER SCIENCE:

- CS 16 - Ralph Taylor will be updated the course outline to make it consistent with the current operating systems
- CS 12 - Massoud Ghyam will be doing a course review to have it be both hybrid and fully online.
- CS ??? - Massoud and Satish will be creating a NEW CS course in Python (the gaming software)

Summer Math Academy:

- SMA Courses – needed to be entered in Curricunet, and reviewed as Non-Credit courses

Checking up on C-IDs Responses: Please follow the instructions below to view the comments.

1) C-ID website https://c-id.net/
2) Click on the tab, Course Review
3) Log in: elcamino
4) Password, 8fdc0f
5) Please click on the tab, View, for the course that needs to be revised. There you will be able to view the comments from the reviewer.

EL CAMINO COLLEGE
Mathematical Sciences
Division Curriculum Committee
February 3, 2015

Present: Sue Bickford, Carl Broderick, Anna Hockman, Greg Fry, Milan Georgevich, Bob Horvath, Ken Key, Lars Kjeseth, Gayathri Manikandan, Trudy Meyer, Ambika Silva, Jackie Sims, Satish Singhal

Math 190

- Math 190 is completed and ready for vote in CurricUNET.
- L'Hopital's Rule was added to "Outline of Subject Matter" for Math 190.
- The first day to submit material is 2/13/15.
- G. Fry completed Math 190. It is 100% compliant to C-ID (thus far).
- Motion to approve Math 190 by M. Georgevich. Unanimous decision to approve.

Math 210

- G. Fry completed Math 210 and it is 100% compliant to C-ID course: Comp 152 "Discrete Structures." This required more topics and the addition of another unit. It is ready for vote in CurricUNET.
- The current Math 210, is a combination of the C-ID: Math 160 "Discrete Math" and the Computer Science 152 "Discrete Structures." It currently articulates with UC and CSU schools. In order to be C-ID compliant, we had to make a choice, and we chose to comply with the Computer Science Discrete Structures.
- Changes to Math 210 has already been discussed and approved by the Computer Science Dept. We would like to cross list this course under both Math and Computer Science.
- The committee discussed submitting an application to raise the units from 4 units to 5 as extra topics have been added. Once there is a unit change, the course will need to go through a full review.
- It will need to be determined whether or not Math 210 is a major requirement for the AS-T degree and if C-ID is mandatory if it is not a major requirement.
- Before voting on Math 210, we need to explore changing the units, and the issues with the C-ID.

Math 25

- Math 25 was deactivated in fall 2014. It will need to be removed as a prerequisite course from the following courses:
  - Math 33 – This course is taught at Compton. G. Manikandan will find out if Compton faculty wants to make any additional changes to Math 33 and will inform L. Kjeseth.
  - Math 40
  - Math 67
- L. Kjeseth will remove the Math 25 prerequisite.

Engineering

- M. Georgevich will lead the Engineering 1 course review. The textbook will be updated.
- There is a possibility to cross list Engineering 1 with other disciplines.
- Engineering 10 may be reactivated. J. Evensizer will need to review the course and explore student interest and transferability .

Computer Science

- R. Taylor will update the course outline for CS 16 to make it consistent with the current operating systems.
- M. Ghyam will work on course outlines for CS 12 to have it be both hybrid and fully online.
- The two major topics for CS 1 should be separated.

Summer Math Academy

- The Summer Math Academy categories still needs to be entered into CurricUNET by April. A proposal for non-credit will be submitted. Lori Suekawa will need to inform us of which category non-credit should be under.
- SMA Math 12 will be entered shortly.

C-ID Progress

- The status of the courses that were submitted for C-ID approval was reviewed.
- Math 190 and 191 were incorrectly submitted as a group course, but they have now been submitted under the correct C-ID courses.
- CS 2 and CS 16 have been approved.

Carnegie Unit

- The Chancellor's Office is stating that the college must use the Carnegie Unit method.
- A. Hockman will send information regarding this method to the committee.

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C-ID
COURSE IDENTIFICATION NUMBERING SYSTEM

DESCRIPTOR

Discipline: Computer Science (COMP)	Sub-discipline:
General Course Title: **Discrete Structures**	Min. Units 3

General Course Description:

This course is an introduction to the discrete structures used in Computer Science with an emphasis on their applications. Topics covered include: Functions, Relations and Sets; Basic Logic; Proof Techniques; Basics of Counting; Graphs and Trees; and Discrete Probability.

Number: COMP 152	Suffix:

Fifth course in a sequence of courses that is compliant with the standards of the Association for Computing Machinery (ACM).

Required Prerequisites or Co-Requisites[1] Prerequisite: COMP 122

Advisories/Recommended Preparation[2]

Course Content:

I. Functions, Relations and Sets

1. Functions (surjections, injections, inverses, composition)
2. Relations (reflexivity, symmetry, transitivity, equivalence relations)
3. Sets (Venn diagrams, complements, Cartesian products, power sets)
4. Pigeonhole principles
5. Cardinality and countability

II. Basic Logic

1. Propositional logic
2. Logical connectives
3. Truth tables
4. Normal forms (conjunctive and disjunctive)
5. Validity
6. Predicate logic
7. Universal and existential quantification
8. Modus ponens and modus tollens
9. Limitations of predicate logic

III. Proof Techniques

1. Notions of implication, converse, inverse, contrapositive, negation, and contradiction
2. The structure of mathematical proofs
3. Direct proofs
4. Proof by counterexample
5. Proof by contradiction
6. Mathematical induction

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[1] Prerequisite or co-requisite course need to be validated at the CCC level in accordance with Title 5 regulations; co-requisites for CCCs are the linked courses that must be taken at the same time as the primary or target course.

[2] Advisories or recommended preparation will not require validation but are recommendations to be considered by the student prior to enrolling.

C-ID

7. Strong induction
8. Recursive mathematical definitions
9. Well orderings

IV. Basics of Counting

1. Counting arguments
2. Sum and product rule
3. Inclusion-exclusion principle
4. Arithmetic and geometric progressions
5. Fibonacci numbers
6. The pigeonhole principle
7. Permutations and combinations
8. Basic definitions
9. Pascal's identity
10. The binomial theorem
11. Solving recurrence relations
12. Common examples
13. The Master theorem

V. Graphs and Trees

1. Trees
2. Undirected graphs
3. Directed graphs
4. Spanning trees/forests
5. Traversal strategies

VI. Discrete Probability

1. Finite probability space, probability measure, events
2. Conditional probability, independence, Bayes' theorem
3. Integer random variables, expectation
4. Law of large numbers

Laboratory Activities: (if applicable)

Course Objectives: *At the conclusion of this course, the student should be able to:*

1. Describe how formal tools of symbolic logic are used to model real-life situations, including those arising in computing contexts such as program correctness, database queries, and algorithms.
2. Relate the ideas of mathematical induction to recursion and recursively defined structures.
3. Analyze a problem to create relevant recurrence equations.
4. Demonstrate different traversal methods for trees and graphs.
5. Apply the binomial theorem to independent events and Bayes' theorem to dependent events.

El Camino College

COURSE OUTLINE OF RECORD - Pending

I. GENERAL COURSE INFORMATION

Subject and Number:	Mathematics 210
Descriptive Title:	Introduction to Discrete Structures
Course Disciplines:	Mathematics
Division:	Mathematical Sciences
Catalog Description:	This course blends mathematical reasoning, combinatorial analysis, discrete structures, algorithmic thinking and modeling to study the problems that occur in computer science and mathematics. Topics covered include: logic, sets, proofs, functions, relations, number theory, counting, graphs and trees.
Conditions of Enrollment:	Prerequisite Mathematics 190 with a minimum grade of C
Course Length:	[X] Full Term [ ] Other (Specify number of weeks):
Hours Lecture:	5.00 hours per week [ ] TBA
Hours Laboratory:	0 hours per week [ ] TBA
Course Units:	5.00
Grading Method:	Letter
Credit Status	Associate Degree Credit
Transfer CSU:	[X] Effective Date: Prior to July 1992
Transfer UC:	[X] Effective Date: Prior to July 1992
General Education:	
El Camino College:	4B – Language and Rationality – Communication and Analytical Thinking Term: Other: 6 – Mathematics Competency Term: Other:
CSU GE:	B4 - Mathematics/Quantitative Thinking

Term: Fall 2000 Other:

IGETC: 2A - Mathematical Concepts and Quantitative Reasoning

Term: Fall 2000 Other:

II. OUTCOMES AND OBJECTIVES

A. COURSE STUDENT LEARNING OUTCOMES (The course student learning outcomes are listed below, along with a representative assessment method for each. Student learning outcomes are not subject to review, revision or approval by the College Curriculum Committee)

1. CONCEPTS - Students will explain and demonstrate an understanding of the key principles of logic, number theory, combinatorics, probability and graph theory.
2. PROBLEMS - Students will use logic, functions, number theory, and combinatorics to solve a variety of problems, including application problems and computer science algorithm analysis.
3. GRAPHS - Students will analyze and solve problems in graph theory.
4. PROOFS - Students will analyze and construct proofs in logic, number theory, combinatorics, probability and graph theory.

The above SLOs were the most recent available SLOs at the time of course review. For the most current SLO statements, visit the El Camino College SLO webpage at http://www.elcamino.edu/academics/slo/.

B. Course Student Learning Objectives (The major learning objective for students enrolled in this course are listed below, along with a representative assessment method for each)

1. Use the standard operations and techniques of propositional logic and set algebra to analyze statements and arguments.

   Objective Exams

2. Use functions, sequences, and series to analyze computer science structures such as strings and hash functions.

   Objective Exams

3. Analyze the growth of functions and the complexity of algorithms.

   Objective Exams

4. Use the Division and Euclidean algorithms, and related techniques, to find prime factorizations, least common multiples, and greatest common factors, to change bases, and to perform modular arithmetic.

   Objective Exams

5. Prove mathematical theorems using direct or indirect proofs, trivial proofs, proofs by contradiction or contraposition, proofs by cases, combinatorial proofs, counterexample, and mathematical induction.

   Objective Exams

6. Define and evaluate sequences and sets recursively.

   Objective Exams

7. Model and solve combinatoric problems using permutations, combinations, inclusion-exclusion, the pigeonhole principle, and recurrence relations.

   Objective Exams

8. Represent relations using matrices and digraphs, and determine if a relation is an equivalence relation.

   Objective Exams

9. Solve problems and prove theorems in graph theory that relate to connectivity, isomorphisms, planar graphs, Euler and Hamilton paths, and spanning trees.

   Objective Exams

III. OUTLINE OF SUBJECT MATTER (Topics are detailed enough to enable a qualified instructor to determine the major areas that should be covered as well as ensure consistency from instructor to instructor and semester to semester.)

Lecture or Lab	Approximate Hours	Topic Number	Major Topic
Lecture	8	I	BASIC LOGIC A. Propositional Logic B. Logical connectives C. Truth tables D. Normal forms (conjunctive and disjunctive) E. Validity F. Predicate logic and its limitations G. Universal and existential quantifiers H. Rules of inference, including modus ponens and modus tollens
Lecture	10	II	SETS AND FUNCTIONS A. Sets and set operations, including complements B. Venn diagrams C. Cartesian products D. Power sets E. Functions and growth of functions F. Surjections, injections and bijections G. Inverses and composition H. Cardinality and countability I. Sequences and Series
Lecture	8	III	METHODS OF PROOF A. Notions of implication, converse, inverse, contrapositive and negation B. Direct proofs C. Proof by contraposition

			D. Proof by contradiction E. Proof by counterexample F. Proof by cases G. Trivial proofs
Lecture	10	IV	ALGORITHMS A. Evaluating algorithms B. Complexity of algorithms C. Integers and division D. Primes and Greatest Common Divisors E. Matrices F. Cryptography
Lecture	10	V	BASICS OF COUNTING AND COMBINATORICS A. Basic counting arguments B. Sum and product rule C. Inclusion-exclusion principle D. Arithmetic and geometric progressions E. Fibonacci numbers F. Pigeonhole principle G. Permutations and combinations H. Generalized permutations and combinations I. Pascal's identity J. The binomial theorem K. The Master Theorem
Lecture	6	VI	DISCRETE PROBABILITY A. Finite probability spaces B. Probability measures and events C. Conditional probability D. Independent and dependent events E. Bayes' Theorem F. Integer random variables G. Expected value and variance H. Law of large numbers
Lecture	8	VII	INDUCTION AND RECURSION A. First principle of mathematical induction B. Second principle of mathematical induction (strong induction) C. Well ordering D. Recursive mathematical definitions E. Setting up and solving recurrence relations F. Program correctness

Lecture	6	VIII	RELATIONS A. Reflexivity, symmetry and transitivity B. Representations C. Equivalence relations D. Database queries
Lecture	10	IX	GRAPH THEORY A. Graph terminology B. Directed and undirected graphs C. Representations of graphs D. Graph isomorphisms E. Connectivity F. Euler and Hamiltonian paths
Lecture	6	X	TREES A. Traversal strategies B. Spanning trees and forests C. Minimal spanning trees
Lecture	8	XI	BOOLEAN ALGEBRA A. Boolean functions B. Representations C. Logic gates D. Minimization of circuits
Total Lecture Hours	90		
Total Laboratory Hours	0		
Total Hours	90		

IV. PRIMARY METHOD OF EVALUATION AND SAMPLE ASSIGNMENTS

A. PRIMARY METHOD OF EVALUATION:

Problem solving demonstrations (computational or non-computational)

B. TYPICAL ASSIGNMENT USING PRIMARY METHOD OF EVALUATION:

Let P(x) be the statement "student x knows calculus" and let Q(y) be the statement "class y contains a student who knows calculus." Express each of the statements below as quantifications of P(x) and Q(y) in symbolic form, negate it, then translate the negation back to regular English.

(a) Some students know calculus

(b) Not every student knows calculus

(c) Every class has a student in it who knows calculus

(d) Every student in every class knows calculus

(e) There is at least one class with no students who know calculus

C. **COLLEGE-LEVEL CRITICAL THINKING ASSIGNMENTS:**

1. A bagel shop has onion, poppy seed, egg, salt, pumpernickel, sesame seed, raisin, and plain bagels. How many ways are there to choose

   a. A dozen bagels?

   b. A dozen bagels with at least one of each kind?

   c. A dozen bagels with at least three egg bagels and no more than two salt bagels.

2. A new breeding pair of rabbits is placed on an island. A pair of rabbits does not breed until they are two months old. After they are two months old, each breeding pair of rabbits produces another breeding pair each month. a. Find a recurrence relation for the number of breeding pairs of rabbits on the island after n months, assuming that rabbits never die. b. Find a solution to this recurrence relation.

D. **OTHER TYPICAL ASSESSMENT AND EVALUATION METHODS:**

Objective Exams

Other exams

Quizzes

Homework Problems

V. INSTRUCTIONAL METHODS

Lecture

Note: In compliance with Board Policies 1600 and 3410, Title 5 California Code of Regulations, the Rehabilitation Act of 1973, and Sections 504 and 508 of the Americans with Disabilities Act, instruction delivery shall provide access, full inclusion, and effective communication for students with disabilities.

VI. WORK OUTSIDE OF CLASS

Study

Answer questions
Required reading
Problem solving activities

Estimated Independent Study Hours per Week: 8

VII. TEXTS AND MATERIALS

A. **UP-TO-DATE REPRESENTATIVE TEXTBOOKS**
Kenneth Rosen. Discrete Mathematics and Its Applications. 7th ed. McGraw Hill, 2012.

B. **ALTERNATIVE TEXTBOOKS**

C. **REQUIRED SUPPLEMENTARY READINGS**

D. **OTHER REQUIRED MATERIALS**
Graphing or scientific calculator

VIII. CONDITIONS OF ENROLLMENT

A. Requisites (Course and Non-Course Prerequisites and Corequisites)

Requisites	Category and Justification
Course Prerequisite Mathematics-190	Sequential

B. Requisite Skills

Requisite Skills
1. Problem solving using a computer algebra system. MATH 190 - Use computing software to solve calculus problems.
2. Knowledge of how to use theorems to solve problems and to prove theorems. MATH 190 - Calculate definite integrals, both using evaluating the limit of Riemann sums and using the fundamental theorem of calculus.

C. Recommended Preparations (Course and Non-Course)

Recommended Preparation	Category and Justification

D. Recommended Skills

Recommended Skills

E. Enrollment Limitations

Enrollment Limitations and Category	Enrollment Limitations Impact

Course created by Geoffrey Jones on 10/01/1987.

BOARD APPROVAL DATE: