LSC Use Only Proposal No:	UWUCC Use Only Proposal No: 13-129.
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Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

Contact Person(s) Francisco Alarcon	Email Address falarcon@iup.edu
Proposing Department/Unit Mathematics	Phone 724-357-2608

Check all appropriate lines and complete all information. Use a separate cover sheet for each course proposal and/or program proposal.

1. Course Proposals (check all that apply)

- ☐ New Course
- ☐ Course Prefix Change
- ☐ Course Deletion
- ☑ Course Revision
- ☐ Course Number and/or Title Change
- ☑ Catalog Description Change

Current course prefix, number and full title: MATH 219 Discrete Mathematics

Proposed course prefix, number and full title, if changing:

2. Liberal Studies Course Designations, as appropriate

This course is also proposed as a Liberal Studies Course (please mark the appropriate categories below)

- ☐ Learning Skills
- ☐ Knowledge Area
- ☐ Global and Multicultural Awareness
- ☐ Writing Across the Curriculum (W Course)
- ☐ Liberal Studies Elective (please mark the designation(s) that applies – must meet at least one)
  - ☐ Global Citizenship
  - ☐ Information Literacy
  - ☐ Oral Communication
  - ☐ Quantitative Reasoning
  - ☐ Scientific Literacy
  - ☐ Technological Literacy

3. Other Designations, as appropriate

- ☐ Honors College Course
- ☐ Other: (e.g. Women's Studies, Pan African)

4. Program Proposals

- ☐ Catalog Description Change
- ☐ Program Revision
- ☐ Program Title Change
- ☐ New Track
- ☐ New Degree Program
- ☐ New Minor Program
- ☐ Liberal Studies Requirement Changes
- ☐ Other

Current program name:

Proposed program name, if changing:

5. Approvals	Signature	Date
Department Curriculum Committee Chair(s)		4/20/12
Department Chairperson(s)	Edel Reilly	4/20/12
College Curriculum Committee Chair	Anne Kondo	4/20/12
College Dean		4/20/12
Director of Liberal Studies (as needed)		
Director of Honors College (as needed)		
Provost (as needed)		
Additional signature (with title) as appropriate		
UWUCC Co-Chairs	Gail Sechrist	10/15/13

Received
AUG 28 2013
Liberal Studies

Received
APR 22 2012
Liberal Studies

Part II: Description of Curriculum Change

1. New Syllabus of Record

I. Catalog Description

MATH 219 Discrete Mathematics

3c-0l-3cr

Prerequisites: COSC 110 and either MATH 125 or MATH 121

Topics include set algebra, mappings, relations, semigroups, groups, directed and undirected graphs, Boolean algebra, and propositional logic, with examples and applications of these various areas of computer science. Emphasis is placed on developing an intuitive understanding of basic structures rather than formal theories and influence of these topics on theory and practice of computing.

II. Course Outcomes and Assessment (Expected Undergraduate Student Learning Outcomes – EUSLO)

The student will:

Objective 1:
Analyze and use the basics of logic, set theory, and relations.
Expected Student Learning Outcomes 1 and 2:
Informed and Empowered Learners
Rationale:
The students will analyze logical arguments for validity. Also, students will construct valid cogent mathematical arguments. This provides the students with methods of organized thinking, which will enable them to solve complex problems using categorical methods.

Objective 2:
Use set theoretical, graphical, and matrix interpretations of relations.
Expected Student Learning Outcomes 1 and 2:
Informed and Empowered Learners
Rationale:
Using relations, students will gain a deeper understanding of the means of comparing mathematical objects, such as sets or numbers. Using relations, students will observe that within data collections, certain pieces of data are related to others by specific rules. Technology will be used to verify these observations and exhibit the desired correspondences.

Objective 3:
Classify relations based on properties they satisfy.

Expected Student Learning Outcomes 1 and 2:
Informed and Empowered Learners
Rationale:
Using properties of relations, students will decide whether one object is bigger or smaller than another in terms of some measure of size. Students will determine whether two objects are considered the same relative to given mathematical properties.

Objective 4:
Apply various types of relations to computer science.
Expected Student Learning Outcomes 1 and 2:
Informed and Empowered Learners
Rationale:
Students will apply the general notions associated with relations to databases. Beyond the simple observation that databases provide examples of relations, students will implement natural database queries through general constructs for relations. Students will implement relations as scheme data structures.

Objective 5:
Apply basic structures of abstract algebra and their applications to computer science.
Expected Student Learning Outcomes 1 and 2:
Informed and Empowered Learners
Rationale:
Students will be able to understand and employ complex coding and encryption techniques using the basic structures of abstract algebra.

III. Detailed Course Outline

A. Fundamentals (8 hours)
   1. Sets and Subsets
   2. Sequences
   3. Operations on Sets
   4. Counting Sequences and Subsets
   5. Algorithms and Pseudocode
   6. Induction and Recursion
   7. Division in the Integers
   8. Matrices

B. Relations and Digraphs (7 hours)
   1. Product Sets and Partitions
   2. Relations and Digraphs
   3. Paths in Relations and Digraphs
   4. Properties of Relations
   5. Computer Representations of Relations and Digraphs
   6. Manipulation of Relations
   7. Connectivity and Warshall's Algorithm

C. Functions (4 hours)
   1. Functions

2. Permutations

D. Trees and Languages (8 hours)
   1. Trees
   2. Labeled Trees
   3. Languages
   4. Representations of Special Grammars
   5. Tree Searching
   6. Undirected Trees

E. Semigroups and Groups (6 hours)
   1. Binary Operations
   2. Semigroups
   3. Products and Quotients of Semigroups
   4. Groups
   5. Products and Quotients of Groups

F. Finite-State Machines and Languages (6 hours)
   1. Finite-State Machines
   2. Semigroups, Machines, and Languages
   3. Machines and Regular Languages
   4. Simplification of Machines

This syllabus covers 39 hours, leaving 3 hours for testing and/or review.

There are also 2 hours for a final exam or concluding activity.

IV. Evaluation Methods

The final grade for the course will be determined as follows:

Homework	15%
Quizzes	10%
3 exams	54%
Comprehensive Final	21%

V. Grading Scale

Grades will be assigned as follows:

A: 90%-100%
B: 80%-89%
C: 70%-79%
D: 60%-69%
F: 0%-59%

VI. Undergraduate Attendance Policy

Although there is no formal attendance policy for this class, student learning is enhanced by regular attendance and participation in class discussions. [Note: It is recommended that an attendance policy be developed by individual faculty and included in student

syllabi. (See undergraduate catalog for Undergraduate Course Attendance Policy.)]

VII. Required Textbooks, Supplemental Books and Readings

Rosen, K., *Discrete Mathematics and its Applications*, Seventh Edition, McGraw Hill, 2012.

Green, J., *How Many Women Mathematicians Can You Name?*, Math Horizons, Vol. 9, No. 2, p. 9, 2001

Cooney, M., *Celebrating Women in Mathematics*, The National Council of Teachers of Mathematics, 1996.

VIII. Special Resource Requirements.

Students should have access to a calculator with graphical and symbolic capabilities.

IX. Bibliography

Epp, Susanna. *Discrete Mathematics with Applications*, Fourth Edition, Brooks/Cole, 2010

Ferland, Kevin. *Discrete Mathematics*, First Edition, Brooks/Cole, 2008.

Johnsonbaugh, Richard. *Discrete Mathematics*, 7th ed., Prentice Hall, 2008.

Kolman, Bernard, et al. *Discrete Mathematical Structures for Computer Science*, Sixth Edition, Prentice Hall, 2008.

Scheinerman, Edward. *Mathematics: A Discrete Introduction*, Third Edition, Brooks/Cole, 2013.

2. Summary of the proposed revisions

1. Objectives – the course objectives were revised from the original syllabus of record and aligned with the Expected Undergraduate Student Learning Outcomes (EUSLO) and Common Learning Objectives found in the criteria for a mathematics course.

2. Common Learning Objectives for a mathematics course are met in the content portion of the course (not necessarily a specific revision but it should be noted that the objectives for the new curriculum have been met). These objectives are:

- understand deductive reasoning and apply it in the problem-solving process.
- apply appropriate techniques to solve a variety of problems.
- interpret, understand, and apply mathematical formulas appropriate to the course.
- interpret, analyze, and use numerical data and graphs.
- develop simple mathematical models to solve problems.

3. Updated the required textbook to reflect the textbook currently being used in the course.
4. Change to the prerequisites: from MATH 122 to MATH 121.

3. Justification/Rationale for the revision

MATH 123 was eliminated as a four credit course, replaced with the three credit course MATH 125. This class is aimed largely at computer science majors. The Computer Science department changed their requirement so that their majors only need MATH 121, not MATH 122.

4. Old Syllabus of record

Syllabus of Record

I. Catalog Description

MATH 219 Discrete Mathematics

3 semester hours
3 lecture hours
0 lab hours
(3c-0l-3sh)

Prerequisites: COSC 110 and MATH 123, or MATH 122

Topics include set algebra, mappings, relations, semigroups, groups, directed and undirected graphs, Boolean algebra, and propositional logic, with examples and applications of these various areas of computer science. Emphasis is placed on developing an intuitive understanding of basic structures rather than formal theories and influence of these topics on theory and practice of computing.

II. Course Objectives

1. Students will know the basics of logic, set theory, and relations
2. Students will know set theoretical, graphic, and matrix interpretations of relations.

3. Students will know classifications of relations based on properties they satisfy.
4. Students will know applications of various types of relations to computer science.
5. Students will know basic structures of abstract algebra and their applications to computer science.

III. Course Outline/Time Schedule:

A. Fundamentals (8-9 hours)
   1. Sets and Subsets
   2. Sequences
   3. Operations on Sets
   4. Counting Sequences and Subsets
   5. Algorithms and Pseudocode
   6. Induction and Recursion
   7. Division in the Integers
   8. Matrices

B. Relations and Digraphs (7 hours)
   1. Product Sets and Partitions
   2. Relations and Digraphs
   3. Paths in Relations and Digraphs
   4. Properties of Relations
   5. Computer Representations of Relations and Digraphs
   6. Manipulation of Relations
   7. Connectivity and Warshall's Algorithm

C. Functions (3-4 hours)
   1. Functions
   2. Permutations

D. Trees and Languages (7-8 hours)
   1. Trees
   2. Labeled Trees
   3. Languages
   4. Representations of Special Grammars
   5. Tree Searching
   6. Undirected Trees

E. Semigroups and Groups (6-7 hours)
   1. Binary Operations
   2. Semigroups
   3. Products and Quotients of Semigroups
   4. Groups
   5. Products and Quotients of Groups

F. Finite-State Machines and Languages (5-6 hours)
   1. Finite-State Machines
   2. Semigroups, Machines, and Languages
   3. Machines and Regular Languages

4. Simplification of Machines

Depending on orientation and time, one may include the following topics.

G. Order Relations and Structures (6-7 hours)
   1. Partially Ordered Sets
   2. Extremal Elements of Partially Ordered Sets
   3. Lattices
   4. Boolean Algebra
   5. Implementation of Boolean Functions

H. Groups and Coding
   1. Coding of Binary Information and Error Detection (3-4 hours)
   2. Decoding and Error Correction

IV. Method of Instruction

This course is taught in a traditional classroom setting involving lecture, student participation in class, homework assignments, and written in-class evaluations. Computer programming assignments are optional.

V. Evaluation Methods

The final grade for the course will be determined as follows:

25% weekly quizzes and/or collected homework assignments.
75% three exams and a comprehensive final examination.

Grades will be assigned as follows:

A: 90%-100%
B: 80%-89%
C: 70%-79%
D: 60%-69%
F: 0%-59%

VI. Required Textbooks, Supplemental Books and Readings

Required Textbook: Kolman, Bernard, and Busby, Robert, and Ross, Sharon Cutler, Discrete Mathematical Structures for Computer Science, 4th Ed., Prentice Hall, New Jersey, 2000.

VII. Special Resource Requirements.

VIII. Bibliography

5. Assignment instructions for one major course assignment and a grading rubric for that assignment