



# BROWARD COMMUNITY COLLEGE COURSE OUTLINE

**LAST REVIEW:** 2005-2006  
*(i.e. 2003-2004)*

**NEXT REVIEW:** 2010-2011  
*(i.e. 2008-2009)*

**STATUS:** A  
*(A, I, D)*

**COURSE TITLE:** Discrete Mathematics

**COMMON COURSE NUMBER:** MAD 2104

**CREDIT HOURS:** 3

**CONTACT HOUR BREAKDOWN**

*(per 16 week term)*

**CLOCK HOURS:**  
*(Voc. Course ONLY)*

Lecture: 48 Lab:

Clinic: Other:

**PREREQUISITE(S):** MAC 1140 or MAC 1114 or MAC 2233 with a C or better or recommendation of the mathematics department.

**COREQUISITE(S):** None

**PRE/COREQUISITE(S):** None

**COURSE DESCRIPTION** *(750 characters, maximum):*

This course will emphasize mathematical theory, formal methods of proof, and applied problem-solving techniques. Topics include formal proof, sets, logic, functions, probability, relations, graphs, trees, and Boolean algebra

General Education Requirements – Associate of Arts Degree (AA), meets Area(s): Area

General Education Requirements – Associate in Science Degree (AS), meets Area(s): Area

General Education Requirements – Associate in Applied Science Degree (AAS), meets Area(s): Area

## UNIT TITLES

1. **Introductory Set Theory**
2. **Formal Logic**
3. **Functions**
4. **Recursion**
5. **Methods of Proof**
6. **Algorithms**
7. **Counting and Probability**
8. **Relations (optional)**
9. **Graphs and Trees**



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## ASSESSMENT:

Please provide a brief description (250 characters maximum) that details how students will be assessed on the course outcomes.

Students will be assessed on the course outcomes of this course in a variety of ways. They will be assessed with chapter tests, quizzes on one or more sections, midterm exams and final exams.

*\*\*\* Complete the following only if course is seeking general education status \*\*\**

## GENERAL EDUCATION Competencies and Skills\*:

Please highlight in green font all Competencies/Skills from the list below that apply to this course. In the box to the right of the Competency/Skill, enter all specific learning outcome numbers (i.e. 1.1, 2.7, 5.12) that apply.

1. Read with critical comprehension	
2. Speak and listen effectively	
3. Write clearly and coherently	
4. Think creatively, logically, critically, and reflectively (analyze, synthesize, apply, and evaluate)	all
5. Demonstrate and apply literacy in its various forms: (highlight in green ALL that apply) ( 1. technological, 2. informational, 3. mathematical, 4. scientific, 5. cultural, 6. historical, 7. aesthetic and/or 8. environmental )	all
6. Apply problem solving techniques to real-world experiences	1.4, 6.1, 6.2, 7.6, 7.10, 4.3
7. Apply methods of scientific inquiry	
8. Demonstrate an understanding of the physical and biological environment and how it is impacted by human beings	
9. Demonstrate an understanding of and appreciation for human diversities and commonalities	
10. Collaborate with others to achieve common goals.	
11. Research, synthesize and produce original work	
12. Practice ethical behavior	
13. Demonstrate self-direction and self motivation	
14. Assume responsibility for and understand the impact of personal behaviors on self and society	
15. Contribute to the welfare of the community	

*\* General Education Competencies and Skills endorsed by '05-'06 General Education Task Force*



# BROWARD COMMUNITY COLLEGE COURSE OUTLINE

Common Course Number: MAD 2104

## UNITS

### Unit 1: Introductory set theory

#### General Outcome:

- 1.0 The student shall understand sets, prove various theorems about sets, and solve problems involving sets.

#### Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 1.1 Determine the complement of a given set
- 1.2 Identify subsets of a given set and use subsets to prove set equality
- 1.3 Perform set operations
- 1.4 Interpret and apply Venn diagrams to solve problems and determine relationships among sets
- 1.5 Identify set equivalences and apply DeMorgan's Laws for sets



# BROWARD COMMUNITY COLLEGE COURSE OUTLINE

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## Unit 2: Formal logic

### General Outcome:

2.0 The student shall understand formal logic, prove various theorems about logic, and solve problems involving logic.

### Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 2.1 Determine the negation of logical statements
- 2.2 Compute the conjunction, disjunction, and other logical operatives
- 2.3 Identify logical equivalences and apply DeMorgan's Laws for logic
- 2.4 Construct truth tables
- 2.5 Identify the validity of a formal logical argument
- 2.6 Perform calculations related to Boolean algebra



**Common Course Number: MAD 2104**

**Unit 3: Functions**

General Outcome:

- 3.0 The student shall understand functions and their properties. Also, the students shall solve problems involving functions and complete proofs of various properties of functions.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 3.1 Identify a function by definition and classify relations as functions or not
- 3.2 Distinguish between discrete functions and continuous functions
- 3.3 Identify the domain, range, and codomain of a given function
- 3.4 Classify a function as an injection, surjection, or bijection
- 3.5 Compute the inverse of a function and understand the properties of an inverse function
- 3.6 Create the composition of functions and understand the properties of the composition
- 3.7 Identify some important functions and their properties. These functions may include step functions, piecewise functions, and other miscellaneous discrete mappings.



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**Unit 4: Recursion**

General Outcome:

- 4.0 The student shall solve problems involving recursion, solve recursions, and write recursive algorithms.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 4.1 Identify the relationship between a recursive definition and an explicit definition
- 4.2 Solve first order recursive relations
- 4.3\* Apply recursive algorithms to write computer programs.

\*optional



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**Unit 5: Methods of proof**

General Outcome:

5.0 The student shall understand various methods of proof and be able to construct formal proofs.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 5.1 Use mathematical induction to prove a given statement
- 5.2 Use a direct proof to verify a given statement
- 5.3 Employ an indirect proof to verify a given statement
- 5.4 Utilize proof by contradiction to verify a given statement
- 5.5 Use a counter-example to disprove a statement



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**Unit 6: Algorithms**

General Outcome:

- 6.0 The student shall write algorithms and understand some common algorithms

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 6.1 Describe what an algorithm is and how it can be applied to programming
- 6.2 Create and apply an algorithm to accomplish a given task
- 6.3 Identify some important algorithms (e.g., sorting)
- 6.4\* Recognize the complexity of algorithms, identify the order of a given algorithm, and create an algorithm with minimum order.

\*optional



**Common Course Number: MAD 2104**

**Unit 7: Counting and probability**

General Outcome:

7.0 The student shall solve counting problems and use counting to find probabilities. The student will also understand discrete and continuous distributions and be able to prove some basic results.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 7.1 Create a tree diagram for a sample space
- 7.2\* Understand the pigeonhole principle and use it to solve counting problems
- 7.3 Use the Fundamental Counting Principle to solve counting problems
- 7.4 Solve problems involving mutually exclusive events and disjunctive statements
- 7.5 Solve problems involving independent events, conjunctive statements, and conditional probability
- 7.6 Apply combinations and permutations to problem solving
- 7.7\* Understand binomial coefficients and their applications to probability
- 7.8 Understand the theory of and solve problems related to discrete probability distributions
- 7.9 Work with intersections and unions of events to solve probability problems
- 7.10 Compute expected value and variance and prove some basic results using these concepts
- 7.11\* Use the inclusion/exclusion principal and Bayes' Theorem to solve problems



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7.12\* Understand probability theory and prove basic probability theorems

\*optional



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**Unit 8: Relations**

General Outcome:

8.0 The student shall identify relations, represent relations, and identify various properties that a relation possesses. The student shall also be able to prove various results about relations.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 8.1\* Demonstrate knowledge of the definition of a relation and associated properties.
- 8.2\* Represent relations with graphs and matrices.
- 8.3\* Identify equivalence relations.
- 8.4\* Classify a relation as a partial ordering, total ordering, or as well ordered.

\*optional



**Common Course Number: MAD 2104**

**Unit 9:       Graphs and trees**

General Outcome:

9.0     The student shall understand basic terminology of graphs and digraphs, paths, and circuits. The student shall also be able to represent graphs using matrices and tables and write algorithms for searching graphs. The student shall also use graphs and trees to solve problems.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 9.1     Identify the definitions of graphs and trees
- 9.2     Identify graph terminology and graph properties
- 9.3     Construct graph isomorphisms
- 9.4     Solve connectivity and shortest path problems
- 9.5     Identify Euler and Hamiltonian paths and circuits
- 9.6     Identify planar graphs and graph coloring schemes
- 9.7     Solve tree-traversal problems
- 9.8     Exhibit spanning trees