# Course Mappings for CS 325 – Analysis of Algorithms

## Course Outcomes
- Learn advanced mathematical analysis techniques
- Application of analysis methods to algorithms
- Develop the ability to do proofs relative to Computer Science

| Homework Assignments | Rubric: Theory 1-3  
|----------------------|------------------
|                      | Algorithms 1-5   |
| Exams                | Rubric: Theory 1-3  
|                      | Algorithms 1-5   |
Theory (Constructing and Understanding Proofs)

For some proof by contradiction or proof by induction:

1. SYNTAX (Understanding of the mathematical language used)
   a. Inadequate: The use of mathematical notation cannot be understood.
   b. Needs improvement: The intended meaning can be discerned from the proof, but the use of mathematical notation is incorrect in many places.
   c. Adequate: The intended meaning is clear and there are only a few places where the mathematical notation is used incorrectly.
   d. Excellent: The proof is clearly written with correct usage of mathematical notation.

2. SEMANTICS (Understanding of what proof by induction means)
   a. Inadequate: The student has not demonstrated an understanding of the structure of a proof by (contradiction/induction).
   b. Needs improvement: The student seems to understand how a proof by induction (contradiction) is supposed to look, but has difficulty fitting the structure to the specific problem.
   c. Adequate: The student has demonstrated that they understand the logic underlying an induction (contradiction) proof but there are some errors.
   d. Excellent: The student has demonstrated that they understand the logic underlying an proof by induction.

3. LOGIC (Understanding how to tailor the proof technique to the specific problem)
   a. Inadequate: The student's proof fails to address the statement of the theorem.
   b. Needs improvement: The student understands what needs to be proven, but cannot find adequate statements (e.g., an appropriate induction hypothesis) which would logically prove the statement.
   c. Adequate: The student understands the statement of the theorem and how to tailor an induction proof to the problem instance, but fails to complete the argument to form a correct proof.
   d. Excellent: The student provides a logically sound proof.

Algorithms

1. Syntax (Understanding of the notational syntax used to specify algorithms)
   a. Inadequate: The use of notational syntax cannot be understood.
   b. Needs improvement: The intended meaning can be discerned from the notation, but the use of the notation is incorrect in many places.
   c. Adequate: The intended meaning is clear and there are only a few places where the notational syntax is used incorrectly.
   d. Excellent: The notation is clear and syntactically correct.

2. Mechanics (Understanding of how the algorithm works)
   a. Inadequate: The student has not demonstrated an understanding of the algorithm mechanics.
b. Needs improvement: The student has somewhat of a notion of how the algorithm works, but has difficulty understanding its structure and interactions.
c. Adequate: The student has demonstrated an understanding of the algorithm mechanics, but still makes some errors.
d. Excellent: The student has demonstrated a thorough understanding of the algorithm mechanics.

3. Behavior (Understanding the algorithm’s behavior in the context of a specific problem space and a specific parameter space)
   a. Inadequate: The student has not demonstrated an understanding of the algorithm’s behavior.
   b. Needs improvement: The student has somewhat of a notion of how the algorithm behaves, but insufficient to effectively employ the algorithm for problem solving.
   c. Adequate: The student has demonstrated an understanding of the algorithm’s behavior, but still misses some of the subtleties.
   d. Excellent: The student has demonstrated a thorough understanding of the algorithm’s behavior.

4. Application (Understanding how to appropriately match algorithms and problems in order to obtain effective application)
   a. Inadequate: The student has not demonstrated an understanding of how to match algorithms and problems.
   b. Needs improvement: The student has somewhat of a notion of how to match algorithms and problems, but insufficient for effective application.
   c. Adequate: The student has demonstrated an understanding of how to match algorithms and problems, but still misses some of the subtleties.
   d. Excellent: The student has demonstrated a thorough understanding of how to match algorithms and problems.

5. Experimental Analysis (Understanding how to effectively design algorithmic experiments and perform appropriate (statistical) analysis)
   a. Inadequate: The student has not demonstrated an understanding of how to design experiments and perform analysis.
   b. Needs improvement: The student has somewhat of a notion of how to design experiments or perform analysis, but either not both or neither effectively.
   c. Adequate: The student has demonstrated an understanding of how to design experiments and perform analysis, but still misses some of the subtleties.
   d. Excellent: The student has demonstrated a thorough understanding of how designs experiments and perform analysis.