

BS MATH ASSESSMENT PLAN

UNIVERSITY OF CENTRAL ARKANSAS ACADEMIC ASSESSMENT PLAN

Requirements

1. Submit with New Program Proposal
 - a. Programs are encouraged to consult with the Office of University Assessment.
 - b. Contact information assessment@uca.edu
2. Send a copy of the Assessment Plan to the Office of University Assessment, Wingo 215.
3. Update the Program Assessment Plan based upon EAPR or Accreditation Cycles.

Basic Information

Program Name:

BS Mathematics with three tracks: Pure Mathematics, Applied Mathematics, and Data Science

College:

College of Natural Science and Mathematics

Department:

Mathematics

Program Level (check all that apply)

- ☐ Associate's
- ☒ **Bachelor's**
- ☐ Undergraduate Certificate
- ☐ Masters
- ☐ Doctoral
- ☐ Graduate Certificate

Date Plan Submitted: **February 6, 2021**

College Dean & email: **Dr. Stephen Addison (saddison@uca.edu)**

College Curriculum Committee Chairperson & Email: **Dr. Scott Austin (saustin@uca.edu)**

Department Chairperson & email: **Dr. Ramesh Garimella (rameshg@uca.edu)**

Department Curriculum Committee Chairperson & email: **Dr. Garth Johnson (garthj@uca.edu)**

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1. Introduction

- **Purpose**

The purpose of this program is to prepare students to address the mathematical needs of education, business, industry, and government in Arkansas, surrounding states, and the nation. Our high quality, student-centered undergraduate program integrates critical thinking, problem-solving skills, mentored research, and cutting edge technology. The program prepares our majors to succeed in their chosen professions and/or advanced studies.

- **Unit Mission Statement**

The primary mission of the Department of Mathematics is to prepare students to address the mathematical needs of education, business, industry, and government in Arkansas. In support of this mission, the department creates and delivers relevant instructional programs that enable students to acquire an appropriate foundation of mathematical knowledge. These programs consist of courses designed to enhance students' critical thinking, problem solving, communication, and technology skills, and to prepare our majors for advanced studies. The department supports the professional and academic growth of faculty to ensure that programs are forward thinking and adaptive. The secondary mission of the department is to provide professional services to the university and community at large.

2. Student Outcomes

- Learning Outcomes by Program (focused on student performance, clearly stated, and measurable)

Learning Outcome 1: Graduates will have mastered fundamental concepts of calculus.

Learning Outcome 2: Graduates will demonstrate problem solving skills and critical thinking skills.

Learning Outcome 3: Graduates will demonstrate effective oral and written communication of mathematics.

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3. Assessment Cycle

- Assessment Cycle will be determined with assistance from the Office of Assessment

Learning Outcome 1:

- MATH 1496 Calculus I, MATH 1497 Calculus II, and MATH 2471 Calculus III: Students will complete a calculus assessment activity at the end of each calculus course.

Learning Outcome 2:

- MATH 2335 Transitions: Student responses from an assessment activity will be collected at the end of every fall and spring semester. (This course is considered for all students except for Data Science Track.)
- MATH 3360 Rings & Fields: Student responses from an assessment activity will be collected at the end of fall semesters. (This course is considered for Pure Math Track students.)
- MATH 4306 Model & Simulation: Student responses to a class project will be collected at the end of spring semesters.
- MATH 4395 Practicum: Student responses to a class project will be collected every semester.

Learning Outcome 3:

- MATH 4371 Intro to Probability: Students will have their written and oral communication skills evaluated at the end of fall for even years and the end of Summer Session I for odd years.
- MATH 4395 Practicum: Students will have their written and oral communication skills evaluated every semester.

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4. Curriculum Map

This table shows only the specific course requirements for students in this program. Students also take many other elective courses.

		Objectives		
Track	Course Number & Name	1. Graduates will have mastered fundamental concepts of calculus.	2. Graduates will demonstrate problem solving skills and critical thinking skills.	3. Graduates will demonstrate effective oral and written communication of math.
Core Courses	1496 Calculus I	I E	I	I
	1497 Calculus II	R E	R	I
	2335 Transitions †	-	I E	I
	2471 Calculus III	R E	R	I
	3320 Lin Algebra	-	I	I
	4371 Intro Prob	A	A	A E
Applied Math	2441 Math Comp	A	I	I
	3311 Stat Methods	-	R	R
	3331 ODE 1	A	A	A
	4306 Model & Sim	A	A E	A
	4315 PDE ‡	A	A	A
	4340 Num Method ‡	A	A	A
	4373 Reg Analysis ‡	-	A	A
Pure Math	3311 Stat Methods	-	R	R
	3360 Rings & Fields	-	A E	A
	3360 Group Theory	-	A	A
	4362 Adv Calculus	A	A	A
Data Science	2441 Math Comp	A	I	I
	3311 Stat Methods	-	R	R
	4373 Reg Analysis	-	A	A
	3392 Multivar Analysis	-	A	A
	4391 Machine Learn	-	A	A
	4395 Practicum	-	A E	A E

† = Not a core class for Data Science Track.

‡ = Applied Math students have a choice of MATH 4315, MATH 4340, MATH 4373.

I = Introduction – This skill is introduced in the course. The student is not expected to have prior knowledge in the skill.

R = Reinforced – This skill is reinforced in the course. Students are expected to have some prior knowledge in the skill upon entering the course, but that knowledge may be incomplete.

A = Advanced/Applied – This is applied in the course. Students are expected to apply knowledge into an advanced problem or realistic situation.

E = This course is used for assessment evaluation. (Bold box)

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5. Assessment Methods and Measures (Formative and Summative recommended)

- Record the assessment measure(s) that evaluate each student learning outcome (note: each learning outcome should have an associated assessment measure).
- Direct Methods/Measures Preferred/Used at the Course and Program Levels (examples: writing examples, oral examinations, internships, clinicals, quizzes, test, team/group projects and presentations)
- Indirect Methods/Measures Preferred/Used at the Course and Program Levels (examples: surveys, quantitative data, course grades, alumni surveys, student evaluation of instruction)

Learning Outcome 1:

- MATH 1496 Calculus I, MATH 1497 Calculus II, and MATH 2471 Calculus III: This is evaluated using a direct measure of the students' knowledge in calculus.

Learning Outcome 2:

- MATH 2335 Transitions: This is evaluated using a direct measure of the students' knowledge from embedded questions in class assignments.
- MATH 3360 Rings & Fields: This is evaluated using a direct measure of the students' knowledge from embedded questions in class assignments.
- MATH 4306 Model & Simulation: This is evaluated using a direct measure of the students' knowledge from embedded questions in class assignments.
- MATH 4395 Practicum: This is evaluated using a direct measure of the students' knowledge on an individualized research project.

Learning Outcome 3:

- MATH 4371 Intro to Probability: This is evaluated using a direct measure of the students' written and oral communication skills.
- MATH 4395 Practicum: This is evaluated using a direct measure of the students' written and oral communication skills.

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6. Data Collection and Review

- When will data be collected for each outcome?
- How will data be collected for each outcome?

Learning Outcome 1:

- MATH 1496 Calculus I, MATH 1497 Calculus II, and MATH 2471 Calculus III: Students will complete several questions at the end of the semester to assess their understanding on targeted content areas.

Learning Outcome 2:

- MATH 2335 Transitions: Answers for pre-selected questions on a class assignment will be collected to assess this learning outcome.
- MATH 3360 Rings & Fields: Answers for pre-selected questions on a class assignment will be collected to assess this learning outcome.
- MATH 4306 Modeling & Simulation: Student responses will be collected from an end-of-semester project.
- MATH 4395 Practicum: Student responses will be collected from an end-of-semester project.

Learning Outcome 3:

- MATH 4371 Intro to Probability: Students will be required to work on a project, submit a written report, provide a one-page summary, and orally present their findings in the classroom.
- MATH 4395 Practicum: Students will be required to work on a project, submit a written report and orally present their findings.

- What will be the benchmark/target for each outcome?

Learning Outcome 1:

- MATH 1496 Calculus I, MATH 1497 Calculus II, and MATH 2471 Calculus III: At least 80% of the students will average 75% or greater on the total group of calculus assessment questions.

Learning Outcome 2:

- MATH 2335 Transitions: at least 80% of students will average 75% or greater on the total group of embedded questions.
- MATH 3360 Rings & Fields: at least 80% of students will average 75% or greater on the total group of embedded questions.
- MATH 4306 Modeling & Simulation: at least 80% of students will score 70% or higher using a common rubric.
- MATH 4395 Practicum: At least 80% of students will average 75% or greater on an evaluation rubric.

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Learning Outcome 3:

- MATH 4371 Intro to Probability: At least 80% of students will average 35 or greater (out of 50) using a common rubric.
- MATH 4395: At least 80% of students will average 75% or greater on the evaluation rubric.

7. Participation in Assessment Process

- Who will participate in carrying out the assessment plan?
- What will be their specific role/s?

The faculty member for each targeted course will administer the evaluations. The specific questions the students work will be created by a committee.

8. Data Analysis

- **How and will the data and findings be shared with faculty?**

The data and findings will be shared with the fully Mathematics department at an upcoming faculty meeting. The faculty will receive a written and oral presentation on the collected data and findings. This meeting will probably occur early in the fall semester.

- **Who was involved in analyzing the results**

The assessment committee will analyze the results. Certain other faculty members may be included, for instance if a faculty member's course is targeted in the assessment process.

- **How are results aligned to outcomes and benchmarks?**

This will be determined once the results are finalized. The assessment committee will make recommendations to the department if any of the student learning outcomes do not meet established benchmarks. These will be included in the assessment report.

9. What are the plans to evaluate students' post-graduate success?

Data will be collected from the UCA's Office of Institutional Research Exit Interview Questionnaire completed by all graduating seniors and alumni.

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Our goal is that at least 75% of all graduates will be employed in a mathematics related field within six months of graduation or gain admission to graduate school within three years of graduation.

10. What are the plans to evaluate teaching effectiveness?

All faculty members are evaluated using the standard college-wide student evaluation each term.

11. Appendices-Required....Curriculum Maps by Program, Assessment Tools (examples: Rubrics, Surveys, Tests, etc.), any other important materials/documentation.

- Curriculum Maps are found earlier in this document.
- Rubrics are found in Appendices A through C.

12. Submit Assessment Plan

- Send completed form electronically to assessment@uca.edu

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14. Appendix B: Rubrics for Learning Objective 2

Rubric for MATH 2335 Transitions (Two pages)

Induction & Onto proofs					
Item	0 points	5 points	10 points	15 points	20 points
Use of statements	Few, if any, sentences or expressions are statements.	Some sentences were not statements.	Some sentences were not statements, but the writer appeared to understand the underlying gist.	Some sentences were not statements, but ended up being irrelevant to the proof.	Every sentence and expression used is a statement.
Grammar	Scratch work is presented as a proof.	Many sentences are fragments, or some mathematical expressions are nonsense	Many sentences are fragments or some mathematical expressions are nonsense, but the writer appears to understand the underlying gist.	Some sentences are fragments, but the writer appears to understand the underlying gist.	Everything is a sentence or mathematical statement.
Scope of variables	Some variables are both undefined and overloaded.	Some variables are overloaded and could be one of multiple things.	Some variables are used before they are defined.	Some variables are used before they are defined, but their definition is obvious.	Every variable used is defined before it is used.
Logical Flow	Explicitly or implicitly assumed the conclusion. Or the proof was too sketchy to evaluate.	An important statement, or many statements do not follow from previous statements, or the supposed proof consisted of the correct statements presented in the "wrong direction"	Some statements do not follow from previous statements.	Every correct statement follows from previous statements, but the reader has to fill in some details himself (incorrect statements fall under the next category)	Every correct statement follows from previous statements in a clear manner. (incorrect statements fall under the next category)
Correctness of the idea	Failed to state anything relevant to the conclusion, or attempted to prove the wrong result, or the proof was too sketchy to evaluate.	Some claims are false or unjustified.	Some claims are false or unjustified, but the writer appeared to have an understanding of why the conclusion is true.	Some claims are false or unjustified, but ended up being irrelevant to the proof. Or the main point was missed due to an incorrect logical flow. Or there was an obvious typo that was meaningful and incorrect.	Every claim is mathematically valid, the final claim results in the theorem, and the logical flow was at the 15 or 20 point level.

50/100 – The proof is completely off track or missing, but what is written is written well.
 25/100 – The proof is completely off track or missing, but the reader can figure out what the author is trying to do.

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Statements				
1 point	3 points	5 points	8 points	10 points
Incorrect truth value No translation	Incorrect truth value Reasonable translation	Incorrect truth value Correct translation OR Correct truth value No translation	Correct truth value Sketchy translation OR Incorrect truth value with good explanation Correct translation	Correct truth value Correct translation

Reflexive/Symmetric			
2 point	8 points	12 points	20 points
No No or unclear explanation	Yes No or unclear explanation OR No, but the author appears to understand something about reflexivity/symmetric	Yes The author seems to understand the underlying gist OR No Reasonable explanation	Yes The author clearly understands the underlying gist Clear explanation

Transitive			
2 point	8 points	12 points	20 points
Yes No or unclear explanation	No No or unclear explanation OR Yes, but the author appears to understand something about Transitivity	No The author seems to understand the underlying gist OR Yes Reasonable explanation	No The author clearly understands the underlying gist Clear explanation

Sets
1 point for each element correctly place/not place in the set (10 points each)

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Rubric for MATH 3360 Introduction to Rings and Fields (One page)

Proof Grading Rubric (Abstract Algebra)

Item	0 points	5 points	10 points	15 points	20 points
Mathematical Grammar	Scratch work is presented as a proof. Or did not present enough of the proof to evaluate (0 points)	Several major issues Or emailed the proof not as a PDF. (5 points)	Many minor issues, or a couple major issues. Or emailed the proof as a PDF (10 points)	Minor issues, but it's still clear what was intended. (15 points)	The proof is well written and typed. (20 points)
Logical Flow	Explicitly or implicitly assumed the conclusion. Or did not realize there were multiple parts to the proof. Or did not present enough of the proof to evaluate (0 points)	An important statement, or many statements do not follow from previous statements, or the supposed proof consisted of the correct statements presented in the "wrong direction" (5 points)	Some statements do not follow from previous statements. Or the reasoning from one statement to the next is not clear. (10 points)	Every correct statement follows from previous statements, but the reader has to fill in some minor details himself. (15 points) (Incorrect statements fall under the next category)	Every correct statement follows from previous statements in a clear manner. (20 points) (Incorrect statements fall under the next category)
Correctness of the idea	Failed to state anything relevant to the conclusion, or attempted to prove the wrong result. (0 points) (The structure of the proof does not apply; that is in the logical flow)	Some claims are false or unjustified and the writer did not appear to understand why the conclusion is true. (20 points)	The main point was missed due to an incorrect logical flow. (35 points)	Some claims are false or unjustified, but ended up being irrelevant to the proof. Or there was an obvious typo that was meaningful and incorrect. (55 points)	Every claim is mathematically valid, the final claim results in the theorem, and the logical flow was at the 15 or 20 point level. (60 points)

Version 1.7

40/100 – The proof is completely off track, but shows something of merit.
20/100 – The proof is completely off track, but communicates clearly what the author is doing.

Comments are color coded:
Green – things that do not make sense
Blue – things that are incorrect
Orange – things that are mathematically true, but do not follow from what you've said.
Red – all other comments.

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Rubric for MATH 4306 Modeling And Simulation (Two pages)

RUBIC FOR MODELING AND SIMULATION

Group Name:

A. Report

Guidelines	Comments	Points Avail.	Points Receive
1. Format: Does it have a clear, logical format (including Introduction, Conclusion, paragraphing, font size, etc.) 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20		20	
2. The Proposed Question: a/ Is the question clear and focused? 0 1 2 3 4 5 6 7 8 b/ Is the question meaningful and testable scientifically? 0 1 2 3 4 5 6 7 8		16	
3. Methodology: a/ Is the project well-designed? 0 1 2 3 4 5 6 7 8 9 10 b/ Are the variables, parameters etc. defined, appropriate and complete? 0 1 2 3 4 5 6 7 8 9 10 c/ Is the data collection and analysis systematic and appropriately used? 0 1 2 3 4 5 6 7 8 9 10 d/ Are the conclusions effectively supported? 0 1 2 3 4 5 6 7 8 9 10		40	
4. Thoroughness: a/ Is sufficient background provided? 0 1 2 3 4 5 6 7 b/ Is the supporting document clear and well presented? 0 1 2 3 4 5 6 7		14	
5. Creativity: a/ Does the project show creativity in the proposed problem? 0 1 2 3 4 5 b/ Does the project show creativity in the presented solution? 0 1 2 3 4 5		10	
		Total:	

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RUBIC FOR MODELING AND SIMULATION

Group Name:

Date Presented:

B. Presentation

Guidelines	Comments	Points Avail.	Points Receivd
1. Slideshow: a/ Is the slideshow composed in a meaningful way? 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 b/ Are the slides clean and clear? 0 1 2 3 4 5 6 7 8 9 10 c/ Does it have a professional look? 0 1 2 3 4 5 d/ Does it show creativity in formatting, such as choosing theme, transition, font, etc? 0 1 2 3 4 5		35	
2. Presenting Manner: a/ Do the presenters speak loud and clear? 0 1 2 3 4 5 6 7 8 9 10 b/ Do the presenters project confidence? 0 1 2 3 4 5 6 7 8 9 10 c/ Do the presenters engage the audience (by showing enthusiasm, making eye contact, etc.)? 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15		35	
3. Clarity: Is the material clearly presented (symbols are clear, no confusion in reading the slides, etc.)? 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15		15	
4. Response to Questions: Are the answer thorough, clear and to the point? 0 1 2 3 4 5 6 7 8 9 10		10	
5. Asking other people: One question or two questions? 2 5		5	
		Total:	

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Rubric for MATH 4395 Practicum (1 page)

Research Paper Rubric		Name: _____	Date: _____	Score: _____							
Category	Exceeds Standard	5	Meets Standard	4	Nearly Meets Standard	3	Does Not Meet Standard	2	No Evidence	1	Score
Title Page	Title Your Name, Teacher's Name, Course Period, Date, Neatly finished-no errors		Evidence of four		Evidence of 3		Evidence of 2 or less		Absent		
Thesis Statement	Clearly and concisely states the paper's purpose in a single sentence, which is engaging, and thought provoking.		Clearly states the paper's purpose in a single sentence.		States the paper's purpose in a single sentence.		Incomplete and/or unfocused.		Absent, no evidence		
Introduction	The introduction is engaging, states the main topic and previews the structure of the paper.		The introduction states the main topic and previews the structure of the paper.		The introduction states the main topic but does not adequately preview the structure of the paper.		There is no clear introduction or main topic and the structure of the paper is missing.		Absent, no evidence		
Body	Each paragraph has thoughtful supporting detail sentences that develop the main idea.		Each paragraph has sufficient supporting detail sentences that develop the main idea.		Each paragraph lacks supporting detail sentences.		Each paragraph fails to develop the main idea.		Not applicable		
Organization- Structural Development of the Idea	Writer demonstrates logical and subtle sequencing of ideas through well-developed paragraphs; transitions are used to enhance organization.		Paragraph development present but not perfected.		Logical organization; organization of ideas not fully developed.		No evidence of structure or organization.		Not applicable		
Conclusion	The conclusion is engaging and restates the thesis.		The conclusion restates the thesis.		The conclusion does not adequately restate the thesis.		Incomplete and/or unfocused.		Absent		
Mechanics	No errors in punctuation, capitalization and spelling.		Almost no errors in punctuation, capitalization and spelling.		Many errors in punctuation, capitalization and spelling.		Numerous and distracting errors in punctuation, capitalization and spelling.		Not applicable		
Usage	No errors sentence structure and word usage.		Almost no errors in sentence structure and word usage.		Many errors in sentence structure and word usage.		Numerous and distracting errors in sentence structure and word usage.		Not applicable		
Citation	All cited works, both text and visual, are done in the correct format with no errors.		Some cited works, both text and visual, are done in the correct format. Inconsistencies evident.		Few cited works, both text and visual, are done in the correct format.		Absent		Not applicable		
Bibliography	Done in the correct format with no errors. Includes more than 5 major references (e.g. science journal articles, books, but no more than two internet sites. Periodicals available on-line are not considered internet sites)		Done in the correct format with few errors. Includes 5 major references (e.g. science journal articles, books, but no more than two internet sites. Periodicals available on-line are not considered internet).		Done in the correct format with some errors. Includes 4 major references (e.g. science journal articles, books, but no more than two internet sites. Periodicals available on-line are not considered internet).		Done in the correct format with many errors. Includes 3 major references (e.g. science journal articles, books, but no more than two internet sites. Periodicals available on-line are not considered internet sites.)		Absent or the only sites are internet sites.		

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14. Appendix C: Rubrics for Learning Objective 3

Rubric for MATH 4371 Intro Probability (One page)

Group # _____		NUMBERS IN RED COLOR ARE POINTS			
S.No.	CATEGORY	3	2	1	0
PRESENTATION					
1	Slides' Contents	Very legible with few points	Legible but more points	More sentences	More sentences and cluttered
2	Demonstrated understanding of basic concepts and principles of Probability	Very Good	Good	Satisfactory	Poor
3	Analysis & Results	Very Good	Good	Satisfactory	Poor
4	Time-Limit	11-13 minutes long.	7-10 minutes long.	5 - 6 minutes long.	less than 5 minutes OR more than 13 minutes.
5	Answering Questions	Answered all the questions correctly.	Answered almost all the questions correctly.	Answered only few questions correctly.	Answered none of the questions correctly.
Report					
6	Relevant to Responsible Living	Highly relevant	Relevant	Satisfactory	Irrelevant
7	Abstract	Precise and Complete	Complete but very lengthy	Very short and important points are missing	Not complete and not precise.
8	Introduction	Very Good	Good	Satisfactory	Poor
9	Analyses using relevant probability concepts	Very Good	Good	Satisfactory	Poor
10	Results	Very Good	Good	Satisfactory	Poor
11	Discussion & Future Work	Very Good	Good	Satisfactory	Poor
12	Conclusion	Precise and Complete	Complete but very lengthy	Very short and important points are missing	Not complete and not precise.
13	References	Enough relevant references	Not enough relevant references	Very few relevant references	No relevant references
Executive Summary					
14	Executive Summary	Contains more than enough details	Contains just enough details	Does not Contain enough details	No details at all
Attendance					
		8			0
15	Attended all presentations	Yes		No	
				Total (out of 50)	

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Rubric for MATH 4395 Practicum Presentation (1 Page)

Scoring Rubric for Presentations

Category	Scoring Criteria	Total Points	Score
Organization (15 points)	The type of presentation is appropriate for the topic and audience.	5	
	Information is presented in a logical sequence.	5	
	Presentation appropriately cites requisite number of references.	5	
Content (45 points)	Introduction is attention-getting, lays out the problem well, and establishes a framework for the rest of the presentation.	5	
	Technical terms are well-defined in language appropriate for the target audience.	5	
	Presentation contains accurate information.	10	
	Material included is relevant to the overall message/purpose.	10	
	Appropriate amount of material is prepared, and points made reflect well their relative importance.	10	
	There is an obvious conclusion summarizing the presentation.	5	
Presentation (40 points)	Speaker maintains good eye contact with the audience and is appropriately animated (e.g., gestures, moving around, etc.).	5	
	Speaker uses a clear, audible voice.	5	
	Delivery is poised, controlled, and smooth.	5	
	Good language skills and pronunciation are used.	5	
	Visual aids are well prepared, informative, effective, and not distracting.	5	
	Length of presentation is within the assigned time limits.	5	
	Information was well communicated.	10	
Score	Total Points	100	