ENVS 178
Environmental Applications of Data Management and Statistics

WINTER 2020

Instructor:
Dr. Leia M. Minaker
EV3 3239 – 519-888-4567 ext.35615
lminaker@uwaterloo.ca

Office Hours:
Mondays and Tuesdays 2pm-3pm (or by appointment)

Graduate Teaching Assistants:

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natalya Siddhantakar</td>
<td><a href="mailto:natalya.siddhantakar@uwaterloo.ca">natalya.siddhantakar@uwaterloo.ca</a></td>
</tr>
<tr>
<td>Albena Bukurova</td>
<td><a href="mailto:beni.bukurova@uwaterloo.ca">beni.bukurova@uwaterloo.ca</a></td>
</tr>
<tr>
<td>Naomi Sunu</td>
<td><a href="mailto:nsunu@uwaterloo.ca">nsunu@uwaterloo.ca</a></td>
</tr>
<tr>
<td>Syed Abdullah Shah</td>
<td><a href="mailto:sa9shah@uwaterloo.ca">sa9shah@uwaterloo.ca</a></td>
</tr>
<tr>
<td>Marta Veenhof</td>
<td><a href="mailto:marta.veenhof@uwaterloo.ca">marta.veenhof@uwaterloo.ca</a></td>
</tr>
<tr>
<td>Barbara Chrysler</td>
<td><a href="mailto:barb.chrysler@uwaterloo.ca">barb.chrysler@uwaterloo.ca</a></td>
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COURSE OUTLINE

CALENDAR DESCRIPTION
This course introduces techniques for collecting, evaluating, and using data-based evidence in environmental research, including descriptive statistics (measures of centre, variation and shape, and measures of association between two variables), statistical research designs, sampling theory, and fundamental probability theory for inferential statistics. The course also develops skills in using statistical software for data display and analysis.
(Prereq: Not open to students in the Faculty of Mathematics.)

COURSE OBJECTIVES
The objectives for this course fall into three broad thematic areas:

1) Data management and visualization
   a) To introduce students to data management using spreadsheet software
   b) To introduce students to graphing and other data visualization techniques

2) Statistics
   a) To verify knowledge of basic mathematics and develop quantitative aptitude
   b) To provide an introduction to the statistical techniques used to describe data
   c) To provide a foundation for learning more about inferential statistics in future courses

3) Probability

LEARNING MODES
This course consists of weekly lectures, tutorials, and self-directed homework exercises.
Attendance and completing weekly exercises are very important to student success.
Students are expected to:

- **Complete the readings before attending lectures**
- **Complete MyLab homework assignments before attending tutorials**

Keeping up with the readings and assignments is important. The lectures may seem to be too fast if you have not completed the readings ahead of time. Tutorials are an additional time to ask questions about the readings, the lecture, and assignments. You will get the most out of tutorials if you have completed the weekly MyLab homework assignments (due Fridays at 11:59pm).

Lectures are a required component of the course. Lectures are supplementary to the readings and include reviewing software tools for this course. You will require detailed understanding of the readings AND lecture material to do well. Examples from readings will come up in class, but it is not the purpose of lecture to summarize all aspects of the readings. It is your responsibility to ensure you fully comprehend the readings, and ask questions if clarification is required.

**COMMUNICATIONS WITH INSTRUCTOR AND TEACHING ASSISTANTS**

All communication with students must be through either the student’s University of Waterloo email account or via Learn. If a student emails the instructor or TA from a personal account they will be requested to resend the email using their personal University of Waterloo email account.

There are many ways to find answers to your questions about the course. Here are some strategies that you might try (in order of helpfulness):

A. Ask your question during lecture or tutorial so that all students get to benefit from the answer in person.

B. Ask your question on the LEARN discussion board for the week. Read through the discussion posts to ensure your question has not already been asked/answered.

C. Visit one of your TAs during office hours (these hours are posted on LEARN).

D. Email the TA responsible for your tutorial to ask your question. Please use “ENVS 178” in the subject line.

E. Visit Prof Minaker during office hours, which are posted above.

If you would like to get in touch with either the TA or instructor, I highly recommend that you try to meet with them either during class, tutorials or office hours. If you need to send an email to one of your TAs or to the course instructor, please use “ENVS 178” in the subject line or your email will go unanswered. Please remember that there are almost 300 of you, so it may take a while to respond to you. We will all do our best to respond to emails within 48 hours of receipt. Many of us also have families and other obligations, so we will only respond to emails during regular working hours (Monday to Friday, 9am to 5pm).

Please use your UW email accounts for communication outside of lecture and tutorial. Course materials will be available on LEARN and the Pearson MyLAB website. You are responsible for checking their UW email and LEARN accounts regularly for course announcements.
CAUTIONS

The rate at which new information and concepts are presented in university may be faster than previously experienced by students. Students are expected to take detailed notes during lectures and tutorials (even during discussion exercises). Your notes will be an important aid when the time comes to study for exams.

It is essential that students stay up-to-date, particularly with readings, definitions, assumptions, and concepts. Students should:

- Complete readings before each lecture
- Review notes after each lecture
- Review notes after each tutorial
- Ask questions during lectures, tutorial, via the LEARN discussion board, or during office hours if you are unsure about any of the material or feel you are falling behind.

Don’t wait until the mid-term or end of term exams to ask questions.

Completing the readings and attending lectures will not be sufficient to do well in this course. Students are expected to think critically about the material, ask questions, participate in discussion exercises, and begin to develop skills that help them synthesize knowledge from different sources (e.g., lectures, guests, readings, discussions, etc.).

READINGS

CLASS MEETINGS
Lectures occur once a week: TUESDAYS 10:30am to 12:20pm in RCH 101.
Each student is also assigned to a mandatory tutorial (check your class schedule for time/location).

OFFICE HOURS
Dr. Minaker holds office hours on Mondays and Tuesdays, 2pm – 3pm (or by appointment). The Teaching Assistants are also available and ready to help during their office hours. TA office hours will be posted on LEARN.

Office hours are there for you to ask questions or discuss issues that you are experiencing in the course. So please come see your TAs or Dr. Minaker if you require assistance or clarification. We are here to help.

STUDENT EVALUATION
The professor determines the content and establishes the grading rules for all exercises, assignments, and exams. Teaching assistants will help mark under the supervision of the instructor. Your final grade will be calculated as follows:

<table>
<thead>
<tr>
<th>Course Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Homework assignments</td>
<td>35%</td>
</tr>
<tr>
<td>Tutorial attendance</td>
<td>10%</td>
</tr>
<tr>
<td>Mid-term examination</td>
<td>25%</td>
</tr>
</tbody>
</table>
To calculate your final grade in the course, some of your lowest marks will be dropped as follows:

- Your lowest mark on MyLab homework assignments will be dropped.
- Students receiving a higher grade on the final exam than on the mid-term will see their final exam count toward 55% of their final course grade (and the mid-term grade becomes void).

Students receive 1% per tutorial for attending tutorial up to a maximum of 10% (you can miss one tutorial and still receive the full 10% of your grade).

Homework Assignments (35% total): Each MyLab homework assignment is worth 1.5% of your overall grade, for a total of 15% of your grade. The Excel Assignments will be worth 6% (Assignment 1), 7% (Assignment 2), and 7% (Assignment 3).

When determining a student's final grade in the course, the professor will examine the record of each individual student's achievement; the final grade may be adjusted to take into account extenuating and compassionate circumstances and the student's general pattern of achievement in the course.

**PROFESSIONALISM AND ATTENDANCE**

In the Faculty of Environment and at the University of Waterloo, you are expected to communicate with your instructors, staff and fellow students in a mutually respectful and professional manner. Use formal salutations in emails and personal interaction, and be attentive in class.

During lectures and tutorials, ensure that you are not distracting other students. Unless they are being used for a class activity, cell phones are to be silenced or turned off. Laptops can be useful to facilitate note taking but web browsers, social media, games, films, etc. need to be closed and notifications turned off (unless they are being used for a class activity). Use classroom time to listen and absorb the ideas and material presented by the instructor and guest lectures, and participate in discussions or activities. You are expected to pay attention and participate as appropriate. To obtain full marks, students need to complete all homework exercises, be actively engaged in the classroom (notetaking, active listening), and act in a professional manner as defined above. **To succeed in this course, be present at all lectures and tutorials (unless there are extenuating circumstances).**

**ACADEMIC INTEGRITY**

In order to maintain a culture of integrity and professionalism, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility (see https://uwaterloo.ca/academic-integrity/). Students who are unsure what constitutes an academic offence are requested to visit the on-line tutorial at www.lib.uwaterloo.ca/ait/

**HOMEWORK EXERCISES AND ASSIGNMENTS**

To help you prepare for the mid-term and final exams, regular homework assignments are part of this class. Further details regarding assignments will be distributed in class. **Pearson MyLab access is required to complete the assignments, as is a recent version of MS Excel.** Homework is open-book and open-note. Students are expected to complete homework assignments on their own, as students will complete exams on their own (note that exams are not open-book nor open-note). It is natural to discuss challenges encountered with the homework with peers during tutorial or on the LEARN discussion board. In this vein, good habits for group study are encouraged. Tips for ensuring academic integrity while engaging in group study:
• If a peer helps you think through a complicated problem, write notes about the appropriate steps in your own words.
• Take a break after group study (approximately 15-30 minutes, e.g. grab a snack, go for a walk, do some exercise) to give your mind downtime to process what you learned. However, avoid activities that may clutter your mind, e.g. watching YouTube (unless it’s about stats!), checking Facebook.
• Return to your homework assignment on your own and complete it. This ensures that whatever you write/present will be in your own style and words.

Please note that TAs and the instructor are required to report any suspected violation of academic integrity. This includes suspicion that a student submitted work that does not accurately reflect their level of mastery. The University of Waterloo takes its culture of integrity seriously because it prepares you for the professional world. The tips stated above are best practices for individual learning while working in groups. Students are also encouraged to seek guidance from their TAs and/or instructor if they encounter difficulties with homework assignments.

MID-TERM EXAMINATION
A mid-term exam will be held in class on February 11, 2020. The exam will be the entire length of the class. Students arriving late will not be provided with additional time to complete the exam. At the exam, students are allowed to bring water bottles, pens/pencils and standalone handheld calculators (use of calculators on phones or other digital devices is not permitted). All other items must be left at the back or front of the room. The mid-term exam covers all material covered in class at that point and the readings.

FINAL EXAMINATION
There is a compulsory final examination in this course. You are required to be present to write the examination. The examination is scheduled by the registrar and is within the University’s normal examination period. You should not make travel arrangements until they have consulted the final examination time table. The University examination schedule is published by the Registrar during the Fall term.

The final exam covers all material from the course. If you receive a higher grade on the final exam than on the mid-term will see their final exam count toward 55% of their final course grade (and the mid-term grade becomes void).

Term Overview and Required Readings

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Preparatory readings</th>
<th>Assignments due</th>
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</thead>
<tbody>
<tr>
<td>January 7</td>
<td>Course expectations, tools, and resources</td>
<td>Explore MyLab Statistics</td>
<td>INTRO: Math Survey 01: MyLab (Due Jan 10 at 11:59pm)</td>
</tr>
</tbody>
</table>
## Date

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Prepatory readings</th>
<th>Assignments due</th>
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</thead>
<tbody>
<tr>
<td>January 14</td>
<td>Stats starts here; Displaying/describing categorical data</td>
<td>Chapters 1 &amp; 2, Excel</td>
<td>02: MyLab (Due Jan 17 at 11:59pm)</td>
</tr>
<tr>
<td>January 21</td>
<td>Displaying/summarizing quantitative data</td>
<td>Chapter 3</td>
<td>03: MyLab (Due Jan 24 at 11:59pm)</td>
</tr>
<tr>
<td>January 28</td>
<td>Understanding/comparing distributions</td>
<td>Chapter 4</td>
<td><strong>Assignment 1</strong> (Due Jan 28 at 11:59pm) &amp; 04: MyLab (Due Jan 31 at 11:59pm)</td>
</tr>
<tr>
<td>February 4</td>
<td>Standard deviation and the Normal model</td>
<td>Chapter 5</td>
<td>05: MyLab (Due Feb 7 at 11:59pm)</td>
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<td>February 11</td>
<td>Mid-term Exam</td>
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<td>February 18</td>
<td>READING WEEK – NO CLASS</td>
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<td>February 25</td>
<td>Experiments, Observational Studies and Sample Surveys</td>
<td>Chapter 9 &amp; 10</td>
<td>06: MyLab (Due Feb 28 at 11:59pm)</td>
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<td>March 3</td>
<td>Probability</td>
<td>Chapters 11 &amp; 12 (Sections 12.1 – 12.3)</td>
<td><strong>Assignment 2</strong> (Due March 3 at 11:59pm) &amp; 07: MyLab (Due March 6 at 11:59pm)</td>
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<td>March 10</td>
<td>Probability models for random variables</td>
<td>Ch. 13 (exceptions: correlation &amp; covariance, 13.5, 13.8)</td>
<td>08: MyLab (Due March 13 at 11:59pm)</td>
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<tr>
<td>March 17</td>
<td>Scatterplots, association, correlation</td>
<td>Ch. 6 (6.1 – 6.3), Excel</td>
<td>09: MyLab (Due March 20 at 11:59pm)</td>
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<td>March 24</td>
<td>Linear regression &amp; regression wisdom</td>
<td>Chapters 7 &amp; 8</td>
<td>10: MyLab (Due March 27 at 11:59pm)</td>
</tr>
<tr>
<td>March 31</td>
<td>Final Exam Study Session</td>
<td>All Chapters Covered to Date</td>
<td><strong>Assignment 3</strong> (Due April 3 at 11:59pm)</td>
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### STUDENT WEEKLY SCHEDULE (more time will be needed on certain weeks*)

<table>
<thead>
<tr>
<th>Weekly Activity</th>
<th>Tues</th>
<th>Wed</th>
<th>Thurs</th>
<th>Fri</th>
<th>Sat</th>
<th>Sun</th>
<th>Mon</th>
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<tr>
<td>Class (2 hours) (8:30-10:20am on Tuesdays)</td>
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<td>MyLab Homework (~1 hour) (Due by 11:59pm on Fridays)</td>
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<td>Tutorial (1 hour) (Select timings on Mondays)</td>
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<td>Readings for the Next Class (~2 hours)</td>
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*Please note: Your weekly schedule will also include time for completing three Excel assignments (due on Jan 28, March 3 and April 3), study time for the Midterm Exam (Feb 11) and study time for the Final Exam (TBD after classes end in December).
### Policies, Grade Penalties and Special Considerations:

<table>
<thead>
<tr>
<th>Late submissions: All assignments are due at the date and time set by the instructor. Teaching assistants are NOT allowed to change the due dates or times. Due to the size of this class, <strong>late homework assignments will not be accepted.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Computer use:</strong> Assignments must be completed through MyLab Statistics and, where applicable, with MS Excel and word processing software. <strong>For assignments requiring use of Excel, if Excel is not used, the assignment will not be accepted.</strong></td>
</tr>
<tr>
<td><strong>Readability and clarity:</strong> You are expected to submit work that is well organized and written in proper English.</td>
</tr>
<tr>
<td><strong>Examinations and tests:</strong> You are expected to be present at the time examinations are scheduled. <strong>There is a required final examination in the normal examination period as scheduled and administered by the Office of the University Registrar. You should consult the final examination time table before making any December travel plans. No “make-up” examinations are provided to accommodate travel plans.</strong></td>
</tr>
<tr>
<td><strong>Requests for exemptions or compassionate considerations:</strong> These are to be discussed with the professor in advance or as soon as possible. In accord with university policy, official documentation is required for extensions, test deferral or absence from class on medical grounds. <strong>Extensions or exam deferrals will not be granted to accommodate travel plans or other recreational activities.</strong></td>
</tr>
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### Unclaimed Assignments

Unclaimed assignments that are not final exams will be retained until one month after term grades become official in quest. After that time, they will be destroyed in compliance with UW’s confidential shredding procedures ([http://www.adm.uwaterloo.ca/infostor/Confidential%20Shredding%20procedures%202008.htm](http://www.adm.uwaterloo.ca/infostor/Confidential%20Shredding%20procedures%202008.htm)). Final exams will be retained for one year.

### Mental Health

The University of Waterloo, the Faculty of Environment, and your instructors and Teaching Assistants consider students’ well-being to be extremely important. We recognize that throughout the term students may face health challenges – physical and/or emotional. **Please note that help is available.**

Mental health is a serious issue for everyone and can affect your ability to do your best work. Counseling Services ([www.uwaterloo.ca/counselling-services](http://www.uwaterloo.ca/counselling-services)) is an inclusive, non-judgmental, and confidential space for anyone to seek support. They offer confidential counseling for a variety of areas including anxiety, stress management, depression, grief, substance use, sexuality, relationship issues, and much more.

For emergencies, contact the mobile crisis team (available 24 hrs/day) at 519-744-1813 or UW police at 519-888-4911.

### Recording Lecture

Use of recording devices during lectures is only allowed with explicit permission of the instructor of
the course. If allowed, video recordings may only include images of the instructor and not fellow classmates. Posting of videos or links to the video to any website, including but not limited to social media sites such as: facebook, twitter, etc., is strictly prohibited.

**NOTE FOR STUDENTS WITH DISABILITIES**

AccessAbility Services, located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with AccessAbility Services at the beginning of each academic term.

**RELIGIOUS OBSERVANCES**

Please inform the instructor at the beginning of term if special accommodation is needed for religious observances that are not otherwise accounted for in the scheduling of classes and assignments.

**INTELLECTUAL PROPERTY**

Students should be aware that this course contains the intellectual property of their instructor, TAs, and/or the University of Waterloo. Intellectual property includes items such as:

- Lecture content, spoken and written (and any audio/video recording thereof);
- Lecture handouts, presentations, and other materials prepared for the course (e.g., PowerPoint slides);
- Questions or solution sets from various types of assessments (e.g., assignments, quizzes, tests, final exams); and
- Work protected by copyright (e.g., any work authored by the instructor or TA or used by the instructor or TA with permission of the copyright owner).

Course materials and the intellectual property contained therein, are used to enhance a student’s educational experience. However, sharing this intellectual property without the intellectual property owner’s permission is a violation of intellectual property rights. For this reason, it is necessary to ask the instructor, TA and/or the University of Waterloo for permission before uploading and sharing the intellectual property of others online (e.g., to an online repository).

Permission from an instructor, TA or the University is also necessary before sharing the intellectual property of others from completed courses with students taking the same/similar courses in subsequent terms/years. In many cases, instructors might be happy to allow distribution of certain materials. However, doing so without expressed permission is considered a violation of intellectual property rights.

Please alert the instructor if you become aware of intellectual property belonging to others (past or present) circulating, either through the student body or online. The intellectual property rights owner deserves to know (and may have already given their consent).

**RESEARCH ETHICS**

Please also note that the University of Waterloo requires all research conducted by its students, staff, and faculty which involves humans as participants to undergo prior ethics review and clearance through the Director, Office of Human Research and Animal Care (Office). The ethics review and clearance processes are intended to ensure that projects comply with the Office’s Guidelines for Research with Human Participants (Guidelines) as well as those of provincial and federal agencies, and that the safety, rights and welfare of participants are adequately protected. The Guidelines inform researchers about ethical issues and procedures which are of concern when conducting research with humans (e.g. confidentiality, risks and benefits, informed consent).
process, etc.). If the development of your research proposal consists of research that involves humans as participants, then please contact the course instructor for guidance and see http://iris.uwaterloo.ca/ethics/

**ACADEMIC INTEGRITY**
In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check the Office of Academic Integrity for more information.]

**CONSEQUENCES OF ACADEMIC OFFENCES**
A student is expected to know what constitutes academic integrity to avoid committing an academic offence, and to take responsibility for his/her actions. [Check the Office of Academic Integrity for more information.] A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about “rules” for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate associate dean. For information on categories of offences and types of penalties, students should refer to Policy 71, Student Discipline. For typical penalties, check Guidelines for the Assessment of Penalties.

Within ENV, those committing academic offences (e.g. cheating, plagiarism) will be placed on disciplinary probation and will be subject to penalties which may include a grade of 0 on affected course elements, 0 on the course, suspension, and expulsion.

ENV students are strongly encouraged to review the material provided by the university’s Academic Integrity office (see: http://uwaterloo.ca/academicintegrity/Students/index.html).

**GRIEVANCE**
A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4. When in doubt, please be certain to contact the department’s administrative assistant who will provide further assistance.

**APPEALS**
A decision made or penalty imposed under Policy 70, Student Petitions and Grievances (other than a petition) or Policy 71, Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72, Student Appeals.
GRADES
The following Faculty of Environment guidelines are useful in interpreting your grade
(see also https://uwaterloo.ca/environment/undergraduate/student-support/exams-and-grades).

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<tr>
<th>Score Range</th>
<th>Description</th>
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<tbody>
<tr>
<td>80 – 100</td>
<td>Student has demonstrated a full understanding of the subject matter, has capacity to analyze, and has demonstrated critical thinking, shows evidence of creative thinking, familiarity with literature and previous work in the area, highly developed communication and presentation skills. The work is of outstanding quality according to the criteria established for the evaluation.</td>
</tr>
<tr>
<td>70-79</td>
<td>Student has shown good comprehension of subject matter, evidence of critical and creative thought, familiarity with literature and previous work in the subject area, competence in communication and presentation skills, but none of the above to the degree found in the ‘A’ category. The work is of very good quality according to the evaluation criteria.</td>
</tr>
<tr>
<td>65-69</td>
<td>Student has demonstrated some understanding of subject matter and can assimilate and communicate basic aspects of the subject matter. The work is of satisfactory or adequate quality according to evaluation criteria.</td>
</tr>
<tr>
<td>50-64</td>
<td>Student has demonstrated minimal or weak understanding of the subject matter, poorly developed communication skills, inability to apply subject matter understanding in other contexts, and little evidence of critical or creative thinking. The work is of unsatisfactory but passable quality according to evaluation criteria.</td>
</tr>
<tr>
<td>0-49</td>
<td>Inadequate understanding of subject matter, failed to complete course requirements, no demonstration of critical thought, communication skills very poor. The work is clearly of unacceptable quality according to evaluation criteria.</td>
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</table>