CSCI 220 COMPUTER ARCHITECTURE I

Lab Manual

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Introduction

This lab manual should be used as a reference for the CSCI 220 lab. As such, students are encouraged to read it carefully, especially when preparing to submit work to be graded. Much of the information about the lab components is also contained in this manual, so please review the contents. Questions that can be answered by reviewing the lab manual will be answered by telling the student to refer to the lab manual. Students with specific questions about information in this manual should refer to that section when asking their question.

Lab Reports

Communication is extremely important in any career. Properly communicating your work, conclusions, and accomplishments will make you quite valuable to any employer. Poor communication in the workplace may result in less than desirable projects, career stagnation, or even dismissal from your employment. It is important to learn now to properly communicate your work.

Lab reports will be required for all lab projects performed in this course. The number one goal of a lab report is to communicate your experiment and your conclusions to others who are familiar with the field and technology. Anyone reading your lab report should be able to understand your conclusions, reach similar conclusions based on the data you present, and repeat your experiment obtaining similar results. Your goal is to properly document your work for those who come after you, and allow others to verify your results. This is how science works, we don't depend on one person's word, we recreate experiments and analyze the data to insure integrity.

Students often ask for an example lab report, or for a specific format to follow. Ultimately such examples and formats, when blindly followed, do not achieve the desired result, that is, to properly communicate one's work to others in the field. When writing a lab report, remember, the format and previous examples aren't what is important. The most important aspect is to communicate your work, your data, and your conclusions. Below I do give a format, however, blindly following this format will not result in good grades. Communicating your work will result in good grades on your lab reports.

Report Format

A rough lab report format will have some basic parts, as applicable.

- Introduction
- Objective
- Procedure
- Data and Discussion
- Conclusions

Of course all work performed by students must have their name, assignment identification, date, lab partners, and other necessary information clearly indicated at the top of the first page or on an appropriately formatted cover sheet. Good work always has someone standing behind it, either at school or in the workplace. You must always put your name on your work, and make sure it is work that you are proud to put your name on.

Introduction

This part of the report I generally write last, but it goes first in the report. Why? Can you introduce someone you have never met? The same is true of a report. How do you introduce a report that has not been written yet?

The introduction should provide the overall purpose of the report, and give a brief overview of the content of the report. You may include some background on a short report. On a longer report, background may be its own section.

Objective

The objective should clearly state what you are trying to show in this lab experiment. Your purpose of the experiment and hypothesis you wish to prove should be in the objective.

Procedure

The procedure is what allows others to replicate your work. The procedure should be written in such a way that others familiar with the field can easily replicate your results. Please note the modifier "others familiar with the field" and how that changes how you write the procedure. You don't need to go into overly detailed explanations for most steps of your procedure, as you can assume the reader has performed those steps before and is familiar with the methods. You're not teaching someone to do this, merely guiding them in the steps you took to complete the task. This allows others to critique your procedure, suggesting improvements or verifying that you performed the experiment appropriately.

In a report, the Procedure should be written in a narrative form, not in a bulleted or numbered list. You are telling the reader what you did, not giving them instructions for doing it in most cases, so a narrative is fine and makes the report flow better. Numbered or bulleted lists should be used rarely to improve clarity.

The procedure should also include any hardware or software used in the experiment. Lists are appropriate for long lists of components or hardware, but for short lists, mentioning hardware and software in the narrative is fine. All components and hardware should be mentioned.

Data and Discussion

This is the most important part of the report. In this section, you introduce your data and discuss it. The temptation for the student is to dump the data on the page and leave it, with no narrative around it. However, this only serves to confuse the reader. There is data with no indication of how it was obtained or what the meaning of it is. Introduce your data, mentioning each table and graph in the narrative, and then discuss the importance of the data and the conclusions that can be drawn from the data. All data must be discussed in this section. Data that is presented without discussion will be ignored during grading.

Conclusions

The conclusions will repeat part of what you have presented in the Data and Discussion portion of the report. The Conclusions section is a way to pull all of your conclusions together in one place, reminding the reader of the conclusions that can be drawn from the report. Conclusions should be non-trivial, and correspond to the objectives of the experiment. Conclusions such as "The lab was good and I learned a lot" are trivial and have no place in scientific and engineering reports, either academically or professionally.

Figures, Tables, and Equations

All figures, tables, and equations must be properly formatted with appropriate captions. Figures will include circuit diagrams, pictures, and graphs. Tables will include anything presented in a tabular format, including truth tables. Equations include Boolean algebra equations.

Figures should be labeled with a caption **below the figure,** with the word Figure followed by the figure number. A descriptive caption should follow the label. Captions should be no more than two sentences, and most of the time one sentence. The text should refer to the figure using the word Figure followed by the number of the figure. Examples of proper captions for figures can be found in this lab manual.

Tables should be labeled with a caption **above the table,** with the word Table followed by the table number. Captions should be descriptive, and no longer than 2 sentences, with most captions being 1 sentence. Examples of proper captions for tables can be found in this lab manual.

Equations should be numbered **to the right of the equation,** with a simple number of the equation. This makes it easier to reference equations later on in the text of the document. Equations and their numbers should be centered on the page, with at least 1 blank line above and 1 blank line below the equation.

Grading of Lab Reports

Grading of reports will not focus on the mechanics of blindly following the above recommended format, but instead look at how effective the lab report communicated the necessary information. To this end, at least portions of the Written Communication VALUE Rubric[1], created by the Association of American Colleges and Universities, will be used in grading of reports. That rubric is included in Appendix 1 for reference. It should be noted that a perfect score may be obtained despite the writer not following the above formatting advice, and a failing grade earned despite the writer superficially following the above format suggestions. The goal of the report is to properly communicate the information, and the advice given above is designed to increase the ability of the report writer to communicate the information. Following the advice is not a substitute for good writing.

For grading, an actual grading rubric that may be used as derived from the Value Rubric is shown in Table 1.

Academic Integrity

Standards of Academic Integrity will be enforced in any work turned in for this course, including lab reports. Acts that violate the university standards include, but are not limited to, acts of plagiarism, use of unauthorized assistance in completing an assignment, turning in work not belonging to the student, and fabrication of results of an experiment. Acts that violate the standards of Academic Integrity will be dealt with in accordance with University policy, which can be found at https://www5.stcloudstate.edu/Policies/SCSU/Viewer.aspx?id=6.

[1] https://www.aacu.org/value/rubrics/written-communication

Table 1 Example of a grading rubric for lab reports in CSCI 220. In addition to the levels shown, a 0 may be assigned if it is clear that the student didn't attempt to meet the standard.

	Capstone **4**	**Milestones** **3**	 **2**	**Benchmark** **1**
Context and Purpose of Writing	Demonstrates a thorough understanding of the purpose and audience for the report.	Demonstrates adequate consideration of the purpose and audience.	Demonstrates awareness of the purpose and audience of the report.	Demonstrates minimal attention to the purpose and audience of the report.
Content Development	Report contains appropriate content to convey the work done and the writers mastery of the work.	Report contains appropriate content to convey the work done and the importance of the work.	Report contains mostly appropriate content to convey the work done.	Report contains simple ideas to convey the work done.
Formatting	Format conventions are adhered to making the report easy to read and understand.	Format conventions are mostly adhered to making the report easy to understand.	Format conventions are sometimes adhered to, leaving the report difficult to follow in places.	Formatting conventions mostly ignored.
Control of Syntax and Mechanics	Uses graceful language that skillfully communicates meaning to readers with clarity and fluency, and is virtually error-free.	Uses straightforward language that generally conveys meaning to readers. The language in the portfolio has few errors.	Uses language that generally conveys meaning to readers with clarity, although writing may include some errors.	Uses language that sometimes impedes meaning because of errors in usage.

Lab Hardware

The Breadboard

The breadboard or prototype board is where we will connect our circuits. The breadboard, shown in Figure 1, is similar to the one that will be used in the lab. Breadboards are wired to make connections easy for the integrated circuits we will be using in the lab. There are several features of the board we need to pay attention to in the lab. These features are shown in Figure 2. The red lines indicate how the holes that are connected together. You should note that the bus lines on the outside edge are connected vertically (up and down in the picture) and the holes in the middle are connected horizontally (left to right) in the middle, with 5 holes on the left not connected to the 5 holes on the right. This break down the middle allows us to put integrated circuits down the middle of the board and connect each side independently of each other.

We can use small wires, which are in your kit, to connect the integrated circuits with power and other components. Those wires are carefully inserted in appropriate hole to make the connection.

Power is provided using the breadboard power supply in the kit. Figure 3 shows the power supply attached to the breadboard. The lower side of the power supply is the +5 Vdc supply, and the upper side is the +3.3 Vdc supply. We won't be using the +3.3 Vdc supply for these labs. If you make sure and connect it the way it is in the picture, with the connectors lining up with the red and blue lines as shown in the picture, it will make the labs easier to follow.

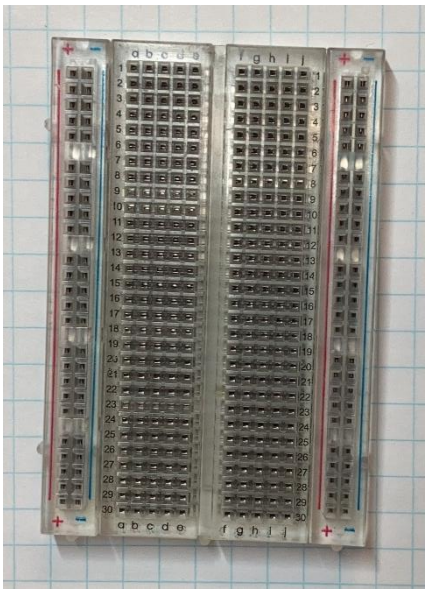


Figure 1 Small breadboard similar to the ones used in the CSCI 220 labs.

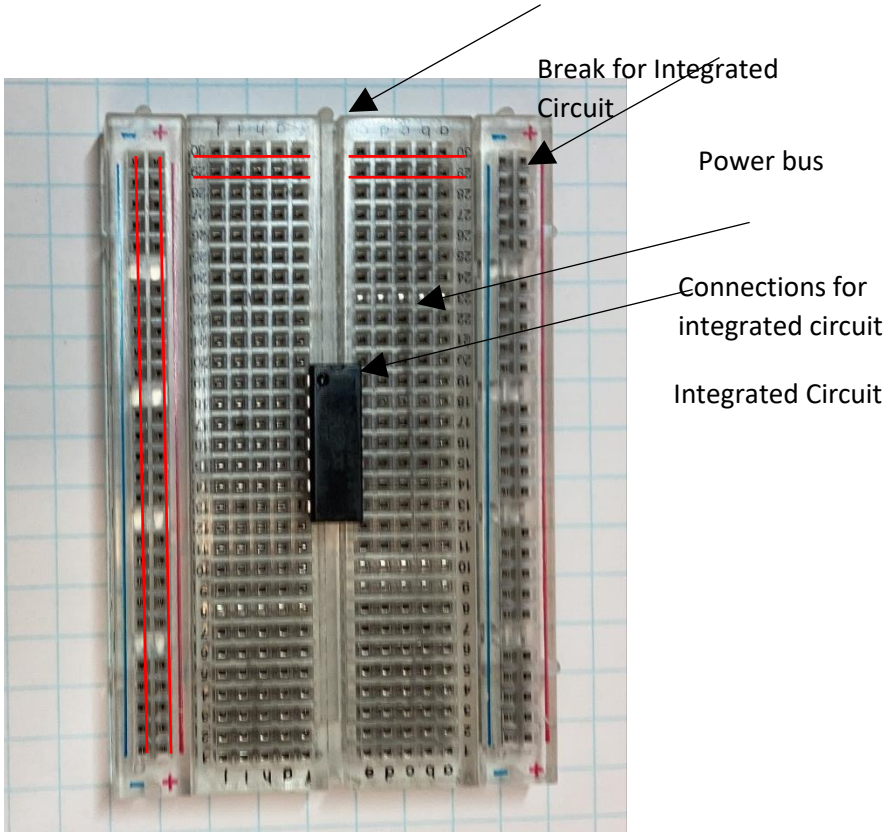


Figure 2 Breadboard showing features of interest for the lab.

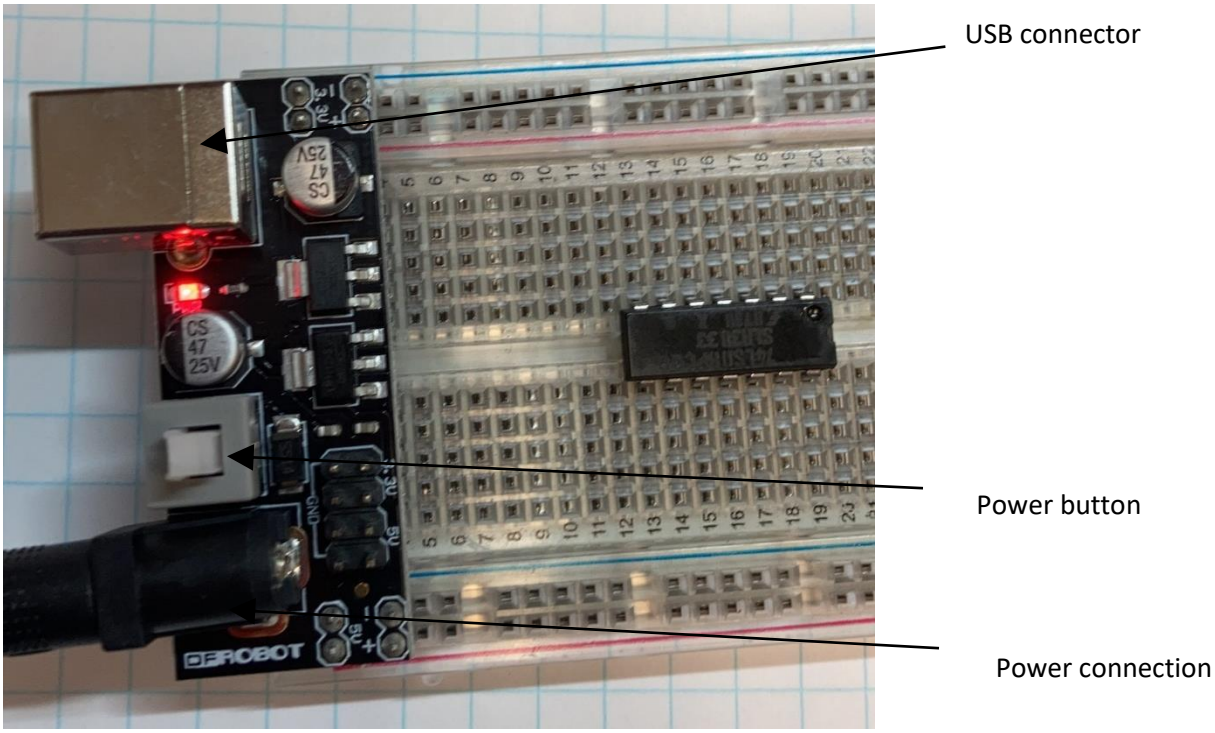


Figure 3 Power supply attached to the breadboard and turned on.

Integrated Circuits

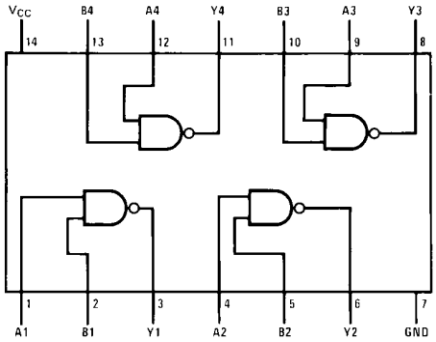
The lab will use integrated circuits that implement the logic functions we wish to investigate. Integrated circuits (known informally as chips) can be used to implement several Boolean algebra equations to produce particular outputs.

> IMPORTANT INSTRUCTION
>
> All integrated circuits require power. The integrated circuits we use in this lab use +5 Vdc, which is provided by the power supply you can attach to the breadboard. You must hook up the +5 Vdc to the pin marked Vcc in the diagram and the – side to the pin marked GND on the diagram. If you don't make the power connection, the integrated circuit will not work.
>
> You should pay close attention to how you wire the circuit. Do not reverse the voltage, and do not put too much voltage into the integrated circuit. The integrated circuits are rated for +5 Vdc input and no more. Your power supply should not supply more than that, so if you wire things correctly, you should be fine.

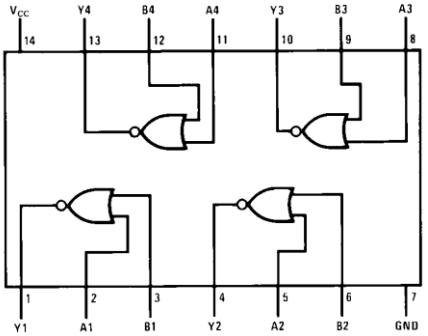
You will note that there is an integrated circuit installed on the breadboard shown in Figure 3. There is a small divot at the "top" of the integrated circuit, and a small indentation indicating pin 1. The part number is stenciled on the integrated circuits. This number can be difficult to read at times, so a strong light and a magnifying glass may be necessary.

The integrated circuits we will use in this lab are as follows:

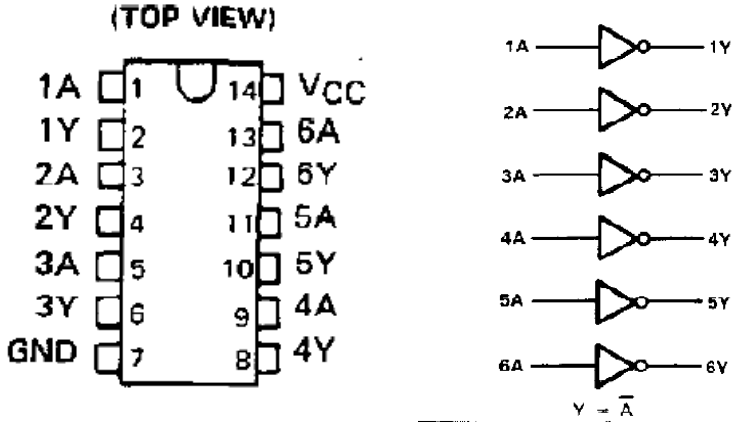
7400, 2 input NAND Gate



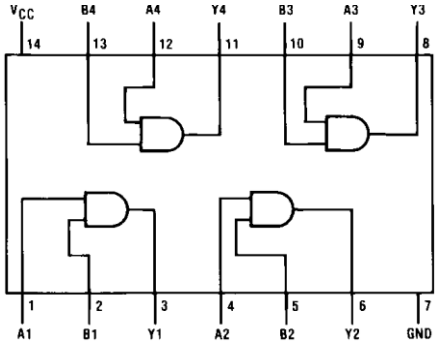
7402 Quad 2-input NOR Gate



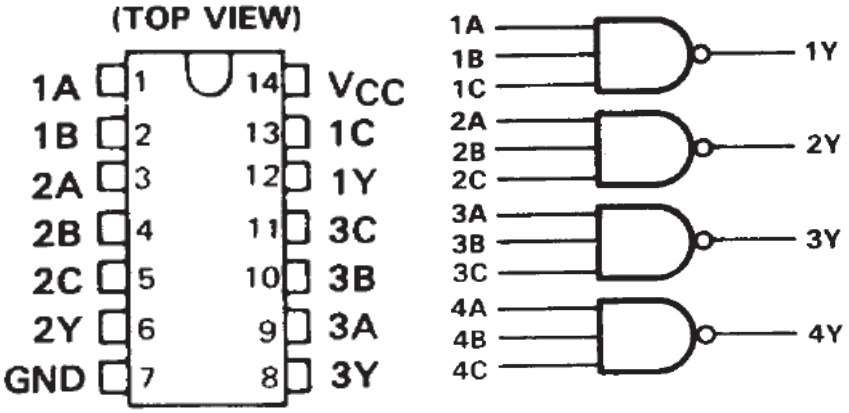
7404 Hex Inverter



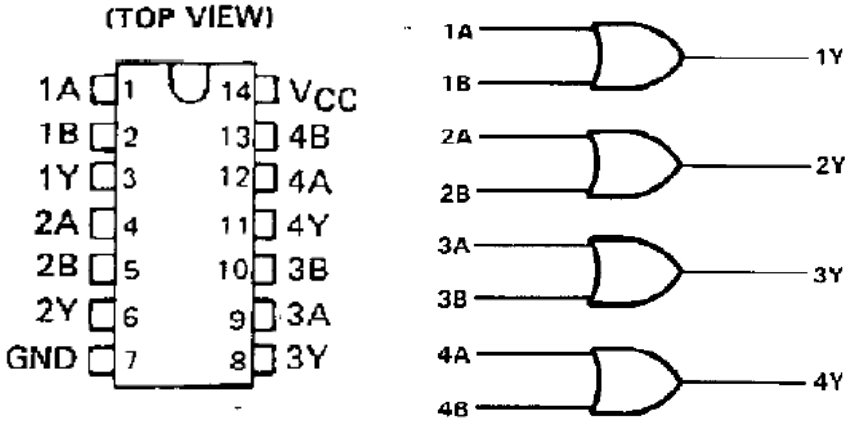
7408 2 input AND Gate



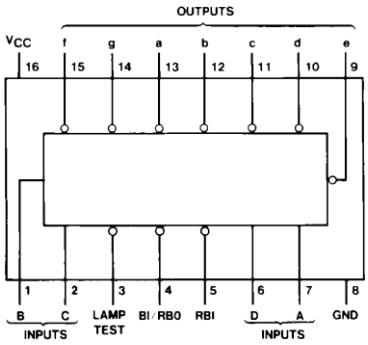
7410 3 input NAND Gate



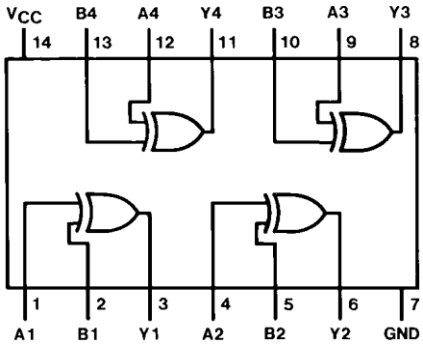
7432 2 input OR Gate



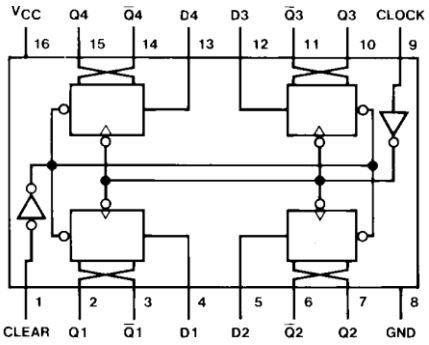
7447 BDC to 7 Segment Display Decoder/Driver



7486 2 input Exclusive OR Gate



74175 D-Type Flip-Flop with Clear



Appendix 1

WRITTEN COMMUNICATION VALUE RUBRIC

for more information, please contact value@aacu.org

Definition

Written communication is the development and expression of ideas in writing. Written communication involves learning to work in many genres and styles. It can involve working with many different writing technologies, and mixing texts, data, and images. Written communication abilities develop through iterative experiences across the curriculum.

Evaluators are encouraged to assign a zero to any work sample or collection of work that does not meet benchmark (cell one) level performance.

	Capstone 4	**Milestones** 3	2
Context of and Purpose for Writing *Includes considerations of audience, purpose, and the circumstances surrounding the writing task(s).*	Demonstrates a thorough understanding of context, audience, and purpose that is responsive to the assigned task(s) and focuses all elements of the work.	Demonstrates adequate consideration of context, audience, and purpose and a clear focus on the assigned task(s) (e.g., the task aligns with audience, purpose, and context).	Demonstrates awareness of context, audience, purpose, and to the assigned tasks(s) (e.g., begins to show awareness of audience's perceptions and assumptions).
Content Development	Uses appropriate, relevant, and compelling content to illustrate mastery of the subject, conveying the writer's understanding, and shaping the whole work.	Uses appropriate, relevant, and compelling content to explore ideas within the context of the discipline and shape the whole work.	Uses appropriate and relevant content to develop and explore ideas through most of the work.
Genre and Disciplinary Conventions *Formal and informal rules inherent in the expectations for writing in particular forms and/or academic fields (please see glossary).*	Demonstrates detailed attention to and successful execution of a wide range of conventions particular to a specific discipline and/or writing task (s) including organization, content, presentation, formatting, and stylistic choices	Demonstrates consistent use of important conventions particular to a specific discipline and/or writing task(s), including organization, content, presentation, and stylistic choices	Follows expectations appropriate to a specific discipline and/or writing task(s) for basic organization, content, and presentation
Sources and Evidence	Demonstrates skillful use of high-quality, credible, relevant sources to develop ideas that are appropriate for the discipline and genre of the writing	Demonstrates consistent use of credible, relevant sources to support ideas that are situated within the discipline and genre of the writing.	Demonstrates an attempt to use credible and/or relevant sources to support ideas that are appropriate for the discipline and genre of the writing.
Control of Syntax and Mechanics	Uses graceful language that skillfully communicates meaning to readers with clarity and fluency, and is virtually error-free.	Uses straightforward language that generally conveys meaning to readers. The language in the portfolio has few errors.	Uses language that generally conveys meaning to readers with clarity, although writing may include some errors.