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# Cognitive Science at Oswego General Education Critical Thinking Assessment

## Plan, 2018

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*This document presents the plan, in general terms, for assessing the critical thinking component of the general education program at Oswego for Cognitive Science majors. The plan will become fully instantiated with two particular activities, one for each of the prescribed learning outcomes, shortly before assessment commences, depending upon the flow of the particular instance of the course in which assessment is performed. The learning outcomes considered are those prescribed by the SUNY committee on critical thinking. The particular questions will vary from assessment to assessment.*

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# 1 The Plan: Introduction, Particulars, Perspective

This document presents the plan for assessing the critical thinking component of the general education program at Oswego for Cognitive Science majors. The learning outcomes considered are those prescribed by the SUNY committee on critical thinking. Data in the form of two essays will be collected in the Cog356 course. Since this course is taken by most Cognitive Science students, a rough computation suggests that slightly less than 25 percent of the students majoring in Cognitive Science will be assessed, on average, during any particular assessment of critical thinking. The students will be juniors or seniors. Two professors will evaluate the work of each student. Findings of this assessment will be discussed with the Cognitive Science Program Advisory Board at a special meeting of the board dedicated to learning outcomes assessment, computer and information literacy assessment, critical thinking assessment, and writing across the curriculum assessment. For the record, here is the specific contextual information called for with respect to this plan, at the time of this writing:

- Critical Thinking is the general education requirement being assessed.
- The learning outcomes for critical thinking will be assessed in the Cog356 "Formal Systems and Generative Processes" course.
- Craig Graci, Director of Cognitive Science at Oswego, will be overseeing the assessment of critical thinking for Cognitive Science majors.
- Since last assessing critical thinking for the program, we have revised the Cognitive Science major in some significant ways. This revision changed the nature of two required computer programming courses in a manner that could very well positively impact what our students learn about critical thinking. It also incorporated a newly crafted course in formal systems and generative processes that most Cognitive Science students enrolled in the major will take for one reason or another. This course includes a module on the use of logic for knowledge representation, problem solving, and formal reasoning.

The remainder of this document includes an enumeration of the learning outcomes to be assessed (for ease of reference), a few words on operationalization of the plan, details pertaining to the assessment of the two critical thinking learning outcomes, and a number of sample activities that are suggestive of those that might be employed in particular manifestations of assessment.

## 2 Learning Outcomes

Two learning outcomes prescribed by a SUNY committee on critical thinking will be assessed in accordance with rubrics provided by the committee.

### • Learning Outcome 1: Argument Identification, Analysis, and Evaluation

1. Identifies the target argument(s) and clearly distinguishes it from any extraneous elements such as expressions of opinion and descriptions of events.
2. Carefully articulates the argument's conclusion, clearly distinguishes it from its premises and identifies most relevant definitions and/or hidden assumptions.

3. Clearly and correctly assesses whether the arguments premises provide sufficient logical support for the conclusion, independently of whether the premises are true.
4. Clearly and correctly assesses the reasonableness of the premises, including the credibility of their sources (e.g., observation, testimony, measurement, experiment, etc.), independently of whether the premises support the conclusion.

• **Learning Outcome 2: Developing a Well-reasoned Argument**

1. Develops a clearly articulated argument, using evidence and/or systematic logical reasoning in support of a conclusion or point of view.
2. Identifies relevant qualifications or objections or alternative points of view and prioritizes evidence and/or reasons in support of the conclusion.
3. Describes the broader relevance, significance or context of the issue and/or applies the reasoning to a novel problem.

## 3 Operationalization of the Plan

The critical thinking assessment for the Cognitive Science program will take place in the Cog356 "Generative Processes and Formal Systems" course, which most students majoring in Cognitive Science will take in their third or fourth year of study. In order to make the assessment meaningful, it will be integrated into the course in the form of required work. Students will be asked to write one 2-3 page essay corresponding to each of the two learning outcomes. Explicitly, students will be given the following instructions for each essay: "Write your essay, and then score your essay according to the given rubric." The rubric will vary with the essay, since one calls for identifying, analyzing, and evaluating an argument, and the other calls for developing a well-reasoned argument. The reason for asking the students to grade themselves according to critical thinking oriented rubrics is simply to assure that students will be thinking about critical thinking as they engaged in the writing of their essays.

The operationalization of assessment for each learning objective will be specified in terms of a featured **activity**, a corresponding **rubric** according to which the activity will be **evaluated**, and a simple **presentation** of the evaluation.

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### Learning Outcome 1: Argument Identification, Analysis, and Evaluation

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#### The Activity

Essay 1: *ARGUMENT*  
Argument Identification, Analysis, and Evaluation

Task: Write a 2 to 3 page double-spaced type-written essay devoted to identifying, analyzing, and evaluating *ARGUMENT*. In doing so, please:

1. Title your essay.
2. Prepare to write by reading the following short texts: *REFERENCES TO SHORT TEXTS*
3. Don't allow yourself to forget that the focus of this essay is on *ARGUMENT* - not some argument that you would like to propose and develop! Moreover, there is no generally acknowledged "right answer" regarding the correctness of *ARGUMENT*.
4. Bear in mind, as you prepare to write, as you write, and as you reflect upon your writing, that this essay will be evaluated on the basis of the following criteria:
  - (a) Have you identified the target argument and clearly distinguished it from any extraneous elements such as expression of opinion and descriptions of events?
  - (b) Have you carefully articulated the argument's conclusion, clearly distinguished it from the premises, and identified the most relevant definitions and/or hidden assumptions?
  - (c) Have you clearly and correctly assessed whether the argument's premises provide sufficient logical support for the conclusion, independently of whether the premises are true?
  - (d) Have you clearly and correctly assessed the reasonableness of the premises, including the credibility of their sources (e.g., observation, testimony, measurement, experiment, etc.), independently of whether the premises support the conclusion?
5. Cite your sources appropriately.
6. Once you have completed your essay, evaluate your work according to the accompanying rubric, which is the very same rubric that I will use to evaluate your work. On the page with the rubric, please (1) place your name near the top of the page, (2) circle one number in each row of the table, and (3) add the circled numbers up and place the sum below the table. **Be certain to hand in the rubric page along with a hard copy of your essay.**
7. Post a .pdf file of your essay to your Web work site.

## The Rubric

Target	Excellent	Good	Marginal	Poor
Good title	3	2	1	0
Proper length	3	2	1	0
Intraparagraph coherence	6	4	2	0
Overall flow	8	6	4	0
Basic writing skills	8	6	4	0
Identifies the target argument(s) and clearly distinguishes it from any extraneous elements such as expressions of opinion and descriptions of events.	16	12	8	0
Carefully articulates the argument's conclusion, clearly distinguishes it from its premises and identifies most relevant definitions and/or hidden assumptions.	16	12	8	0
Clearly and correctly assesses whether the argument's premises provide sufficient logical support for the conclusion, independently of whether the premises are true.	16	12	18	0
Clearly and correctly assesses the reasonableness of the premises, including the credibility of their sources (e.g., observation, testimony, measurement, experiment, etc.), independently of whether the premises support the conclusion.	16	12	8	0
Appropriate use/referencing of sources	8	6	4	0

TOTAL SCORE = TOTALSCORE

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## The Evaluation Process

For the purpose of the assignment, the complete essay rubric presented above will be used. For the purpose of critical thinking assessment, only the four items corresponding to the critical thinking rubric for argument identification, analysis, and evaluation will be used. The terms for the essay rubric (excellent, good, marginal, poor) will be mapped onto the terms for the critical thinking rubric (exceeding, meeting, approaching, not meeting). Results will then be determined according to the following procedure:

1. Each of the assessors will grade the essay for each student, indicating for each item whether the student exceeded, met, approached, or did not meet standards.
2. The categories will be mapped onto numbers in the following way: exceeds → 3 points; meets → 2 points; approaches → 1 point; does not meet → 0 points.
3. The average over the four criteria will be computed for each student for each assessor.
4. The average of the assessor values will be computed.
5. The assessors average value for each student will then be mapped onto one of the four required categories as follows: [0,0.5) → not meeting; [0.5,1.5) → approaching; [1.5,2.5) → meeting; [2.5, 3.0] → exceeding.

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## Presentation of the Evaluation

The result of performing the assessment process on critical thinking learning objective 1 - argument identification, analysis, and evaluation - will be presented in tabular form as suggested by the following structure:

Student	C1	C2	C3	C4	A	C1	C2	C3	C4	A	Average	Assessment

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## Learning Outcome 2: Developing a Well-reasoned Argument

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### The Activity

Essay 2: *IDEA*  
Argument Identification, Analysis, and Evaluation

Task: Write a 2 to 3 page double-spaced type-written essay devoted to developing a well-reasoned argument in support of *IDEA*. In doing so, please:

1. Title your essay.
2. Be sure to establish working definitions of the key terms used to articulate *IDEA*.
3. Prepare to write by reading the following short texts: *REFERENCES TO SHORT TEXTS*
4. Bear in mind, as you prepare to write, as you write, and as you reflect upon your writing, that this essay will be evaluated on the basis of the following criteria:
  - (a) Have you developed a clearly articulated argument, using evidence and/or systematic logical reasoning in support of a conclusion or point of view?
  - (b) Have you identified relevant qualifications or objections or alternative points of view and prioritized evidence and/or reasons in support of the conclusion?
  - (c) Have you described the broader relevance, significance or context of the issue and/or applied the reasoning to a novel problem?
5. Cite your sources appropriately.
6. Once you have completed your essay, evaluate your work according to the accompanying rubric, which is the very same rubric that I will use to evaluate your work. On the page with the rubric, please (1) place your name near the top of the page, (2) circle one number in each row of the table, and (3) add the circled numbers up and place the sum below the table. **Be certain to hand in the rubric page along with a hard copy of your essay.**
7. Post a .pdf file of your essay to your Web work site.

## The Rubric

Target	Excellent	Good	Marginal	Poor
Good title	3	2	1	0
Proper length	3	2	1	0
Intraparagraph coherence	6	4	2	0
Overall flow	8	6	4	0
Basic writing skills	8	6	4	0
Develops a clearly articulated argument, using evidence and/or systematic logical reasoning in support of a conclusion or point of view.	20	15	10	0
Identifies relevant qualifications or objections or alternative points of view and prioritizes evidence and/or reasons in support of the conclusion.	24	18	12	0
Describes the broader relevance, significance or context of the issue and/or applies the reasoning to a novel problem.	20	15	10	0
Appropriate use/referencing of sources	8	6	4	0

TOTAL SCORE = *TOTALSCORE*

## The Evaluation Process

For the purpose of the assignment, the complete essay rubric presented above will be used. For the purpose of critical



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## John Searle's Chinese Room argument against Strong AI

Argument Identification, Analysis, and Evaluation

Write a 2 to 3 page double-spaced type-written essay devoted to identifying, analyzing, and evaluating **John Searle's Chinese Room argument against Strong AI**. In doing so, please:

1. Title your essay.
2. Prepare to write by reading the following short texts:
  - (a) John Searle's "Minds, Brains and Programs" (<http://cogprints.org/7150/1/10.1.1.83.5248.pdf>), where he posits his argument, entertains rebuttals to the argument, and then responds to the rebuttals.
  - (b) The article on the Stanford Encyclopedia of Philosophy site titled "The Chinese Room Argument" (<https://plato.stanford.edu/entries/chinese-room/>) which nicely contextualizes Searle's paper.
  - (c) Any other reasonable accounts pertaining to the question of strong AI that you would like to read. (A Google search will find lots of interesting articles on the task.)
3. Don't allow yourself to forget that the focus of this essay is on Searle's argument not some argument that you would like to propose and develop! Moreover, there is no generally acknowledged "right answer" regarding the correctness of Searle's argument. The realizability of strong AI is one of the most controversial ideas within the realm of cognitive science.
4. Bear in mind, as you prepare to write, as you write, and as you reflect upon your writing, that this essay will be evaluated on the basis of the following criteria:
  - (a) Have you identified the target argument and clearly distinguished it from any extraneous elements such as expression of opinion and descriptions of events?
  - (b) Have you carefully articulated the argument's conclusion, clearly distinguished it from the premises, and identified the most relevant definitions and/or hidden assumptions?
  - (c) Have you clearly and correctly assessed whether the argument's premises provide sufficient logical support for the conclusion, independently of whether the premises are true?
  - (d) Have you clearly and correctly assessed the reasonableness of the premises, including the credibility of their sources (e.g., observation, testimony, measurement, experiment, etc.), independently of whether the premises support the conclusion?
5. Cite your sources appropriately.
6. Once you have completed your essay, evaluate your work according to the accompanying rubric, which is the very same rubric that I will use to evaluate your work. On the page with the rubric, please (1) place your name near the top of the page, (2) circle one number in each row of the table, and (3) add the circled numbers up and place the sum below the table. **Be certain to hand in the rubric page along with a hard copy of your essay.**
7. Post a .pdf file of your essay to your Web work site.

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## Jerry Fodor's Argument for the Modularity of Mind

Argument Identification, Analysis, and Evaluation

Write a 2 to 3 page double-spaced type-written essay devoted to identifying, analyzing, and evaluating **Jerry Fodor's argument for the modularity of mind**. In doing so, please:



1. Title your essay.
2. Prepare to write by reading the following short texts:
  - (a) Jerry Fodor's article "The Modularity of Mind" (<http://www.ucd.ie/artspgs/langmind/Fodor1983.pdf>) in which he articulates the modularity of mind hypothesis for which he is so well known.
  - (b) The article on the Stanford Encyclopedia of Philosophy site titled "Modularity of Mind" (<https://plato.stanford.edu/entries/modularity-mind/>) which nicely discusses the hypothesis.
  - (c) Any other reasonable accounts pertaining to modularity of mind that you would like to read. (A Google search will find lots of interesting articles on the task.)
3. Don't allow yourself to forget that the focus of this essay is on Fodor's argument not some argument that you would like to propose and develop! Moreover, there is no generally acknowledged "right answer" regarding the correctness of Fodor's argument. The modularity of mind hypothesis is one of the most controversial ideas within the realm of cognitive science.
4. Bear in mind, as you prepare to write, as you write, and as you reflect upon your writing, that this essay will be evaluated on the basis of the following criteria:
  - (a) Have you identified the target argument and clearly distinguished it from any extraneous elements such as expression of opinion and descriptions of events?
  - (b) Have you carefully articulated the argument's conclusion, clearly distinguished it from the premises, and identified the most relevant definitions and/or hidden assumptions?
  - (c) Have you clearly and correctly assessed whether the argument's premises provide sufficient logical support for the conclusion, independently of whether the premises are true?
  - (d) Have you clearly and correctly assessed the reasonableness of the premises, including the credibility of their sources (e.g., observation, testimony, measurement, experiment, etc.), independently of whether the premises support the conclusion?
5. Cite your sources appropriately.
6. Once you have completed your essay, evaluate your work according to the accompanying rubric, which is the very same rubric that I will use to evaluate your work. On the page with the rubric, please (1) place your name near the top of the page, (2) circle one number in each row of the table, and (3) add the circled numbers up and place the sum below the table. **Be certain to hand in the rubric page along with a hard copy of your essay.**
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## Potential Learning Outcome 2 Activities

Four potential activities are described that afford opportunities for Cognitive Science students to develop a well-reasoned argument in a manner that is consistent with Learning Outcome 2 and its accompanying rubric. The first activity pertains to the phenomenon observed by evolutionary psychologists that humans tend not to reason logically in abstract, formal situations, but that they do tend to reason logically in certain contextually rich situations. The second idea to be argued is that memetics is a useful tool for understanding creativity. The third argument is that microworld technology is of central importance to the advancement of AI. The fourth is that computing machines can actually create original artifacts.

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## The Relevance of Context to Logical Reasoning

### Developing a Well-reasoned Argument

Write a 2 to 3 page double-spaced type-written essay developing a well-reasoned argument in support of the idea that **humans tend not to reason logically in abstract, formal situations, but that they do tend to reason logically in certain contextually rich situations**. In doing so, please:

1. Title your essay.
2. Be sure to establish working definitions of the key terms used to articulate your argument that humans tend not to reason logically in abstract, formal situations, but that they do tend to reason logically in certain contextually rich situations.
3. Prepare to write by reading the following short texts:
  - (a) The Wikipedia article on the Wason Selection Task ([https://en.wikipedia.org/wiki/Wason\\_selection\\_task](https://en.wikipedia.org/wiki/Wason_selection_task)).
  - (b) The short text from UPenn ([www.ling.upenn.edu/courses/hum100/evolutionary\\_psychology.html](http://www.ling.upenn.edu/courses/hum100/evolutionary_psychology.html)) on Leda Cosmides and the Wason Selection Task.
  - (c) Any other reasonable accounts of the Wason Selection Task and related phenomena that you like. (A Google search will find lots of interesting articles on the task.)
4. Bear in mind, as you prepare to write, as you write, and as you reflect upon your writing, that this essay will be evaluated on the basis of the following criteria:
  - (a) Have you developed a clearly articulated argument, using evidence and/or systematic logical reasoning in support of a conclusion or point of view?
  - (b) Have you identified relevant qualifications or objections or alternative points of view and prioritized evidence and/or reasons in support of the conclusion?
  - (c) Have you described the broader relevance, significance or context of the issue and/or applied the reasoning to a novel problem?
5. Cite your sources appropriately.
6. Once you have completed your essay, evaluate your work according to the accompanying rubric, which is the very same rubric that I will use to evaluate your work. On the page with the rubric, please (1) place your name near the top of the page, (2) circle one number in each row of the table, and (3) add the circled numbers up and place the sum below the table. **Be certain to hand in the rubric page along with a hard copy of your essay.**
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## Memetics is a Useful Tool for Understanding Creativity

### Developing a Well-reasoned Argument

Write a 2 to 3 page double-spaced type-written essay developing a well-reasoned argument in support of the idea that **memetics is a useful tool for understanding creativity**. In doing so, please:

1. Title your essay.
2. Be sure to establish a working definition of creativity, and clearly articulate the Dawkins/Dennett conception of a meme in terms of the trio of characteristics (replication, variation, selection) that definitionally characterize Darwin's theory of evolution.

3. Prepare to write by reading, among any other texts that you may find useful, excerpts or reviews of (1) Darwins Dangerous Idea, by Daniel Dennet, (2) The Meme Machine, by Susan Blackmore, and (3) Darwinian Creativity and Memetics, by Maria Kronfeldner.
4. Bear in mind, as you prepare to write, as you write, and as you reflect upon your writing, that this essay will be evaluated on the basis of the following criteria:
  - (a) Have you developed a clearly articulated argument, using evidence and/or systematic logical reasoning in support of a conclusion or point of view?
  - (b) Have you identified relevant qualifications or objections or alternative points of view and prioritized evidence and/or reasons in support of the conclusion?
  - (c) Have you described the broader relevance, significance or context of the issue and/or applied the reasoning to a novel problem?
5. Cite your sources appropriately.
6. Once you have completed your essay, evaluate your work according to the accompanying rubric, which is the very same rubric that I will use to evaluate your work. On the page with the rubric, please (1) place your name near the top of the page, (2) circle one number in each row of the table, and (3) add the circled numbers up and place the sum below the table. **Be certain to hand in the rubric page along with a hard copy of your essay.**
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## Microworld Technology is of Central Importance to the Advancement of AI

### Developing a Well-reasoned Argument

Write a 2 to 3 page double-spaced type-written essay developing a well-reasoned argument in support of the idea that **microworld technology is of central importance to the advancement of AI**. In doing so, please:

1. Title your essay.
2. Be sure to establish working definitions of microworld and AI, and clearly articulate the Dawkins/Dennett conception of a meme in terms of the trio of characteristics (replication, variation, selection) that definitionally characterize Darwins theory of evolution.
3. Base your argument on Hofstaders research and on early AI research at MIT when Minsky and Papert co-directed the MIT AI Lab. Be sure to introduce at least a couple of specific research projects (at least one of Hofstadters and at least one from MIT) as you develop your argument.
4. Prepare to write by reading (1) what Hofstadter has to say about “The Utility of Small Domains” in Chapter 4 of “Fluid Concepts and Functional Analogies”, (2) what Minsky has to say about microworlds in “Society of Mind”, (3) what Honing has to say about microworlds in his “Computers and the Humanities” article “A microworld approach to the formalization of musical knowledge”, and (4) any other reasonable accounts of the microworld approach to research in AI and cognitive science that you would like to read.
5. Bear in mind, as you prepare to write, as you write, and as you reflect upon your writing, that this essay will be evaluated on the basis of the following criteria:
  - (a) Have you developed a clearly articulated argument, using evidence and/or systematic logical reasoning in support of a conclusion or point of view?
  - (b) Have you identified relevant qualifications or objections or alternative points of view and prioritized evidence and/or reasons in support of the conclusion?
  - (c) Have you described the broader relevance, significance or context of the issue and/or applied the reasoning to a novel problem?

6. Cite your sources appropriately.
7. Once you have completed your essay, evaluate your work according to the accompanying rubric, which is the very same rubric that I will use to evaluate your work. On the page with the rubric, please (1) place your name near the top of the page, (2) circle one number in each row of the table, and (3) add the circled numbers up and place the sum below the table. **Be certain to hand in the rubric page along with a hard copy of your essay.**
8. Post a .pdf file of your essay to your Web work site.

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## Computing Machines Can Create Original Artifacts

### Developing a Well-reasoned Argument

Ada Lovelace once famously wrote, with respect to Charles Babbages great invention, that: The Analytical Engine has no pretensions whatever to originate anything. It can do whatever we know how to order it to perform. It can follow analysis; but it has no power of anticipating any analytical relations or truths. Its province is to assist us in making available what we are already acquainted with. You are being asked to argue that this is not so with respect to modern day computational devices!

Write a 2 to 3 page double-spaced type-written essay developing a well-reasoned argument in support of the idea that **computing machines can create original artifacts**. In doing so, please:

1. Title your essay.
2. Be sure to establish working definitions of originality, be sure to articulate some of the more salient connotations of the concept, and be sure to cite Lady Lovelace's famous words in the beginning of your essay.
3. Prepare to write by reading, among any other texts that you may find useful (1) the relevant parts of the chapter on artificial intelligence (Chapter XVIII) in "Godel, Escher, Bach", (2) some of David Cope's writing on EMI, (3) press and magazine accounts of machine musicianship, machine artistry, and other phenomena related to computational creativity, and (4) excerpts and reviews of books and articles on models of creativity, particularly evolutionary models.
4. Bear in mind, as you prepare to write, as you write, and as you reflect upon your writing, that this essay will be evaluated on the basis of the following criteria:
  - (a) Have you developed a clearly articulated argument, using evidence and/or systematic logical reasoning in support of a conclusion or point of view?
  - (b) Have you identified relevant qualifications or objections or alternative points of view and prioritized evidence and/or reasons in support of the conclusion?
  - (c) Have you described the broader relevance, significance or context of the issue and/or applied the reasoning to a novel problem?
5. Cite your sources appropriately.
6. Once you have completed your essay, evaluate your work according to the accompanying rubric, which is the very same rubric that I will use to evaluate your work. On the page with the rubric, please (1) place your name near the top of the page, (2) circle one number in each row of the table, and (3) add the circled numbers up and place the sum below the table. **Be certain to hand in the rubric page along with a hard copy of your essay.**
7. Post a .pdf file of your essay to your Web work site.