Logic, Reasoning, and Persuasion 07; Deductive Reasoning Problem Set
SOLUTIONS

- Points: 100 (112 possible points including extra credit, but scored out of 100).

1 | Identifying Statements (10 points)

Which of the following are statements? If a sentence *would* be a statement if you removed a word or two (but not more) from it, you can cross out the word(s) and say it is a statement. (2 points each)

1. The tallest mountain in the world is Mount Rushmore.
   → This is a statement.
2. The World Trade Center being 1,776 feet tall.
   → This is not a statement. It is what philosophers sometimes call a "state of affairs". Notice that it works as a noun: "The World Trade Center being 1,776 feet fall is an example of American patriotism." **Note**: can you make this a statement by deleting words? No. If you deleted "being," you would get "The World Trade Center 1,776 feet tall. In order to make it a statement, you have to *add* words, which I didn't say you could do. I didn't take points off here, but in the extra credit, I didn't give points for prompts that didn't make the chatbot realize that you could not get a statement without adding words.
3. Meet me in St. Louis tomorrow.
   → This is not a statement: it is an "imperative," a category that includes commands, requests, and sometimes instructions.
4. You can meet me in New Brunswick tomorrow.
   → This is a statement.
5. Remember, you can use the "statement test" to determine if a sentence is a statement.
   → This is a statement, if you delete "Remember." If you do not delete "Remember," then it is an imperative. **Note**: there is a reason why I allowed deleting, but not adding, words. When you delete a word or two, you generally do not change the type of the sentence (as long as the sentence still makes sense), whereas when you add words it's very easy to change the type of the sentence.

2 | Truth Preservation (20 points)

Recall that an argument is **truth-preserving** if whenever the premises are true, the conclusion is true. The following argument is truth-preserving:

P1. Ella is taller than all other people.
C. Therefore, Ella is taller than most people.

If we assume that Ella is taller than all other people, then just based on the meanings of "all" and "most", we know Ella is taller than most people.

However, the following argument is *not* truth preserving:

P1. Ella is 150 feet tall
C. Therefore, Ella is taller than most people.

Why is it not truth-preserving? Because we can imagine a circumstance where Ella is 150 feet fall, but most people are 200 feet tall.

§2 Truth Preservation (20 points)

For each of the following arguments, say whether they are *truth-preserving*: whether whenever the premise is true, the conclusion is also true. If you think the argument is *not* truth-preserving, give a counterexample: a circumstance in which the premise is true but the conclusion is false. In each case, the premises are labeled P1, P2, etc. and the conclusion is labeled C. 2 points each.

1. P1. Hidden Grounds is the closest coffee shop to the philosophy department.
   C. Therefore, most philosophers at the department go to Hidden Grounds.

   Not truth preserving. Counterexample: most philosophers at the department go to Semicolon, which is a bit farther but has better coffee.[1]
2. P1. Hidden Grounds is the closest coffee shop to the philosophy department.
   P2. Most philosophers at the philosophy department go to the closest coffee shop to the philosophy department.
   C. Therefore, most philosophers at the department go to Hidden Grounds.

   Truth preserving. This is of a logical form that is *similar* to the implication machine, but is *formally* a lot more complicated.
3. P1. Using ChatGPT during an exam in this class is cheating.
   C. Therefore, you should never use ChatGPT during an exam in this class.

   Not truth preserving. Counterexample: a mysterious benefactor has promised that they will end world hunger if you cheat during your exam by using ChatGPT (Note: if this happens to you, I 100% endorse doing it. I'm not the biggest Kantian).
4. P1. Teachers have a responsibility to help students do hard things that will be good for them later.
   P2. With the rise of generative AI, thinking critically for oneself is starting to be a hard thing for students that will be good for them later.
   C. Therefore, teachers are starting to have a responsibility to help students think critically for themselves.

   Ambiguous. There is a way to read P1 that makes this truth-preserving, and another way to read it where it is *not* truth preserving.
   (a) Reading 1: P1 implies that teachers have a responsibility to help students do *every* hard thing that will be good for them later.
   (b) Reading 2: P1 implies that there are *some* hard things that will be good for students later where teachers have a responsibility to help students do them.

   If we adopt reading 1, then the argument is truth-preserving. It is of a logical form similar to the implication machine (but not within the same system), that you should be able to tell is truth-preserving:
   (a) All Xs are Ys.

1. Note: this is not *in fact* true. Actually most of us do go to hidden grounds when we have to buy coffee. The point is that "most philosophers go to Hidden Grounds" doesn't *have* to be true if P1 is true.

(b) *A* is an *X*.
→ Therefore, *A* is a *Y*.

In this form, we can rephrase the argument:

(a) All hard things that are good for students later are things that teachers have a responsibility to help students do.
(b) Thinking critically for oneself is a thing that is good for students later.
→ Therefore, thinking critically for oneself is a thing that teachers have a responsibility to help students do.

Great. But there's a problem. Plausibly, reading 1 is a *bad* reading of P1. Why? Because it also implies the following:

> Learning how to be a chess grandmaster is a hard thing that will be good for students later (because they can become successful chess players). So teachers have a responsibility to teach students how to be chess grandmasters.

Therefore, perhaps we should prefer P2, and say that for only *some* of the hard things do teachers have a responsibility to help students do them. And then the argument is **not** truth preserving. For example, in a world where thinking critically is a good thing but not super important, perhaps there would be more important things for teachers to do. So in order to establish the conclusion C, we'd have to further argue that thinking critically is one of those hard things that give teachers a responsibility (unlike being a chess grandmaster).

5. P1. With the rise of AI, teachers have a responsibility to make sure that students do not have a strong incentive to use AI in coursework.
   C. Therefore, students also have a responsibility to ensure they do not use AI in ways that jeopardize their learning, even when they are tempted to do so.

   Not truth preserving. Counterexample: maybe it's too much to ask students to resist temptation – maybe the entire responsibility is on the teacher. **Note**: even if you think students in fact *do* have the responsibility to ensure they learn properly, it could be just a *separate* fact that doesn't depend on P1. In that case, the transition from P1 to C would not be truth-preserving

6. (Optional, 2 points extra credit) Unfortunately, the original text of the following problem has been scrambled, with each letter being replaced by some other letter. Codebreakers have been unable to decode the message except for the "ifs" and, "thens", and "therefore"s, but we do know that each letter is replaced by the same letter in the scramble (e.g. an "e" always maps to an "a.").
   P1. fvb mpnbylk vba aol jpwoly.
   P2. **If** fvb mpnbylk vba aol jpwoly, **then** fvb kpk leayh dvyr av mpnbyl vba aopz wyvislt.
   C. **Therefore**, fvb kpk leayh dvyr av mpnbyl vba aopz wyvislt.

Truth preserving. What does the message say? First of all, it doesn't matter. All you had to do was notice that the letter themselves were the same in the relevant slots. That is, we could write:

1. P = fvb mpnbylk vba aol jpwoly.
2. Q = fvb kpk leayh dvyr av mpnbyl vba aopz wyvislt

and then we get:

P1. P

P2. **If** P, **then** Q.
C. **Therefore**, Q.

and this is an instance of the implication machine, so we know that it is truth-preserving. The point here is that the logic machines give us arguments that are truth-preserving just because of the *form*, or *shape*, that they take. In philosophy we say these are true "in virtue of form." Because the implication machine gives arguments that are truth in virtue of form, you don't even need to check the content of an argument to know it's truth preserving.

That said, the code was a Caesar Cipher with a shift of 7:

P1. you figured out the cipher
P2. **If** you figured out the cipher, **then** you did extra work to figure out this problem.
C. **Therefore**, you did extra work to figure out this problem.

3 | Implication Machine (20 points)

3.1 | Translating Into Implication Machine

Translate the following sentences into instances of the implication machine: determine what the (statement 1) and (statement 2) are, then write it in the form

> 1. (statement 1)
> 2. **if** (statement 1) **then**
> → (statement 2).

1. (5 points) If you produce writing that looks or sounds like AI, you may be penalized.[2]

   (a) You produce writing that looks or sounds like AI.
   (b) **If** you produce writing that looks or sounds like AI, **then** you may be penalized.
   → You may be penalized.

2. (5 points) Using generative AI is tantamount to plagiarism, since you are falsely representing the chatbot's paper as your own work.[3]

   (a) [By using generative AI] you are falsely representing the chatbot's paper as your own work.
   (b) **If** [by using generative AI] you are falsely representing the chatbot's paper as your own work, **then** using generative AI is tantamount to plagiarism.
   → Using generative AI is tantamount to plagiarism.

2. A paraphrase of Lin, "Why We're Not Using AI in This Course." He writes: "Producing writing that looks or sounds like AI writing may be penalized as poor writing because it doesn't stand out as your authentic voice."
3. Actually the full sentence is "Your professor might think [using generative AI] is tantamount to plagiarism, since you are falsely representing the chatbot's paper as your own work."

The bracketed portion [by using generative AI] is *implicit* in the sentence. Ideally, we add it explicitly to so that the claim "You are falsely representing the chatbot's paper as your own work" is true. (For example: if someone is not using AI, then it wouldn't be true that they are falsely representing a chatbot's paper as their own).

The following is *incorrect*:

(a) Using generative AI is tantamount to plagiarism.

(b) **If** using generative AI is tantamount to plagiarism, **then** [by using generative AI] you are falsely representing the chatbot's paper as your own work.

→ [by using generative AI] you are falsely representing the chatbot's paper as your own work.

3.2 | Translating Out of Implication Machine

Take the following arguments in Implication-Machine form and rewrite them as sentences that someone might present to you as an argument, without using the word "if". You may use each of the following words once total for this part: *because, since, as, so.* Try not to make your sentenes sound awkward!

(5 points)

1. Most math students are using AI for assignments.
2. **if** most math students are using AI for assignments, **then** not using AI for math assignments puts one at a disadvantage.

→ not using AI for math assignments puts one at a disadvantage.

Not using AI for math assignments puts one at a disadvantage, since most math students are using AI for assignments.[a]

a. **Note**: If we switched the P and Q, we'd have a different implication machine, which could be translated: "Most math students are using AI for assignments, since not using AI for math assignments puts one at a disadvantage." Why does it work in both directions? As more students use AI, it becomes more of a disadvantage not to use it, so more students use it.)

(5 points)

1. As technology develops, emerging technologies will be able to do an increasing proportion of specialized tasks.
2. **if**, as technology develops, emerging technologies will be able to do an increasing proportion of specialized tasks, **then** training for specialized tests will be a worse education strategy than developing general competencies.

→ as technology develops, training for specialized tests will be a worse education strategy than developing general competencies.

Two options:

1. As technology develops, emerging technologies will be able to do an increasing proportion of specialized tasks, so training for specialized tests will be a worse education strategy than developing general competencies.
2. As technology develops, training for specialized tests will be a worse education strategy than developing general competencies, because emerging technologies will be able to do an increasing proportion of specialized tasks.

A common mistake was writing something like the following:

> As technology develops, emerging technologies will be able to do an increasing proportion of specialized tasks, because training for specialized tests will be a worse education strategy than developing general competencies.

This gets the order of explanation wrong. In the if...then formulation, the fact that emerging technologies can do more tasks explains why training for specialized tasks will be a worse strategy, not the other way around.

4 | Chain Machine (20 points)

4.1 | Part One (5 points)

I've taken the sentence "I won't use Google Search because I want to protect my privacy" and implemented the General Strategy for the Chain Machine. Fill in the blanks in the last step by finding a middle sentence *M* that further explains.

1: Translate into Implication Machine:

1. I want to protect my privacy.
2. **If** I want to protect my privacy, **then** I won't use Google Search.

→ I won't use Google Search.

*2: Take "**If** P **then** Q" as conclusion of Chain Machine.*

1. **If** *P* **then** _____
2. **If** _____, **then** *Q*

→ **If** I want to protect my privacy, **then** I won't use Google Search.

1. **If** I want to protect my privacy, **then** _____
2. **If** _____, **then** I won't use Google Search.

→ **If** I want to protect my privacy, **then** I won't use Google Search.

3: Find a middle sentence M that further explains the connection between the statements.

To find the middle statement *M*, we want to think about the *connection* between the statements. Why might it be the case that I don't use google search *because* I want to protect my privacy? One obvious possibility is that Google Search is a product that would put my privacy at risk by collecting my personal data. So we can use a middle sentence that makes that connection:

1. **If** I want to protect my privacy, **then** I won't use products that collect my personal data.
2. **If** I won't use products that collect my personal data, **then** I won't use Google Search.

→ **If** I want to protect my privacy, **then** I won't use Google Search.

4.2 | Part Two (5 points)

I've taken the sentence "Our students are tempted to use ChatGPT because we have not successfully shown them why their education matters" and partially implemented the strategy above.[4] Do steps 2 and 3.

1: Translate into Implication Machine:

1. we have not successfully shown [our students] why their education matters.[a]
2. **If** we do not successfully show our students why their education matters, **then** they will be tempted to use ChatGPT.

→ Our students will be tempted to use ChatGPT.

*2: Take "**If** P **then** Q" as conclusion of Chain Machine.*

1. **If** we do not successfully show our students why their education matters, **then M**
2. **If M**, **then** [our students] will be tempted to use ChatGPT.

→ **If** we do not successfully show our students why their education matters, **then** they will be tempted to use ChatGPT.

3: Find a middle sentence M that further explains.

Some options:

1. our students will not value their education
2. our students will not understand why they should do their own work.
3. our students will be tempted to take shortcuts.

a. Note: the brackets around [our students] means that I've replaced the word "them" with the noun that it refers to.

4. Note: the original sentence from Aylsworth and Castro is "Our students are tempted to use ChatGPT, at least in part, because we have not successfully shown them why their education matters." I've deleted "at least in part" because it makes the task more complicated. Is this okay to delete? Why or why not?

4.3 | Part Three (10 points)

Do all three steps of the General Strategy for the Chain Machine for the following sentence (which also appeared in the previous problem):

If you produce writing that looks or sounds like AI, you may be penalized.

1: Translate into Implication Machine:

1. You produce writing that looks or sounds like AI
2. **If** you produce writing that looks or sounds like AI, **then** you may be penalized.

→ you may be penalized.

*2: Take "**If** P **then** Q" as conclusion of Chain Machine.*

1. **If** you produce writing that looks or sounds like AI, **then M**.
2. **If M**, **then** you may be penalized.

→ **If** you produce writing that looks or sounds like AI, **then** you may be penalized.

3: Find a middle sentence M that further explains the conclusion: why you may be penalized if you produce writing that looks or sounds like AI.

What we want here is some **M** such that both of the sentences involving **M** further explain the conclusion, so that **M** provides a "middle link" that explains why producing writing that looks or sounds like AI might get you penalized.

Here's one that works:

> **M**: your instructor may think you did not complete your assignment by yourself.

This seems true and explanatory in both places:

1. **If** you produce writing that looks or sounds like AI, **then** your instructor may think you did not complete your assignment by yourself.
2. **If** your instructor may think you did not complete your assignment by yourself, **then** you may be penalized.

→ **If** you produce writing that looks or sounds like AI, **then** you may be penalized.

Here's one that doesn't work as well:

> **M**: you will have cheated.

Why does this not work as well? Because producing writing that looks or sounds like AI isn't itself cheating, if you didn't *actually* use AI.[a]

a. Something to think about: because of how it works, AI-generated text sounds *sort of* like human-produced text, but not exactly. However, as more people read AI-generated text, human-generated text will start to emulate AI-generated text. The two may get closer together.

5 | Argument Analysis (30 points)

Consider this passage from Aylsworth and Castro:

> *Imagine a philosophy professor gives you a writing assignment in which you are asked to critically assess an idea from an assigned reading. You now have a special opportunity to engage with an expert and present them with your reasoning about a subject that could have a substantial impact on your life. Perhaps you were assigned Singer's Animal Liberation. Rather than reading the text and writing your own paper, you ask ChatGPT to write a response to Singer. It may do an adequate job of generating a paper for a passing grade, but you have missed the opportunity to ask questions about your values—ones that might have changed the course of your life. And if the professor gives you critical comments (as we believe she should), then you have missed the chance to receive feedback about both your thinking process and your conclusions.*

5.1 | Identifying Implication Machines (10 points)

There are **three** portions of this passage that can be analyzed in terms of the Implication Machine. Identify **one** of them and write it in the format of the Implication Machine using the General Strategy for the Implication Machine (5 points each). Note that you may have to rephrase some parts of the passage in order to put it in the right form.

1. P
2. if P then Q

$\rightarrow$ Q.

First Implication Machine:

1. A philosophy professor gives you a writing assignment in which you are asked to critically assess an idea from an assigned reading.
2. **If** a philosophy professor gives you a writing assignment in which you are asked to critically assess an idea from an assigned reading, **then** you have a special opportunity to engage with an expert and present them with your reasoning about a subject that could have a substantial impact on your life.

$\rightarrow$ You have a special opportunity to engage with an expert and present them with your reasoning about a subject that could have a substantial impact on your life.

Second Implication Machine:

1. Rather than reading the text and writing your own paper, you ask ChatGPT to write a response to Singer.
2. **If**, rather than reading the text and writing your own paper, you ask ChatGPT to write a response to Singer, **then** you have missed the opportunity to ask questions about your values — ones that might have changed the course of your life.

$\rightarrow$ You have a special opportunity to engage with an expert and present them with your reasoning about a subject that could have a substantial impact on your life.

Third Implication Machine:

1. The professor gives you critical comments.
2. **If** the professor gives you critical comments, **then** you have missed the chance to receive feedback about both your thinking process and your conclusions.

→ You have missed the chance to receive feedback about both your thinking process and your conclusions.

5.2 | Improving Chain Machines (10 points)

For the passage you analyzed above in terms of the Implication Machine, follow the General Strategy for the Chain Machine:

1. Translate the passage into the Implication Machine (you did this already in the last part of the problem).
2. Take the "**If** P **then** Q" part as the conclusion of the Chain Machine.
3. Find a middle sentence *M* that further explains the connection between *P* and *Q*, and write the final argument in the following form:
   (a) **If** *P* **then** _____ (*M*)
   (b) **If** _____ (*M*), **then** *Q*
   → **If** *P* , **then** *Q*

Some good options for the second implication machine:

1. you do not critically engage yourself with the ideas and arguments in the text.
2. you do not think carefully about the values that Singer is discussing.

Some good options for the third implication machine:

1. the comments are responding to ideas generated by chatGPT, not ideas that arose from your thinking process.
2. the professor is giving feedback to chatGPT, not to you.

5.3 | General Analysis (10 points)

Restate the conclusion that Aylsworth and Castro are arguing for in the passage. You may consider looking back at the paper to see where the passage appears. You can choose as your sentence a direct quote from Aylsworth and Castro, if you cite it, and if it is a **single** sentence.

The following is not the *unique* correct answer, but is a good option:

> If a philosophy professor gives you a writing assignment in which you are asked to critically assess an idea from an assigned reading and ask generative AI to write your paper, then you have missed the opportunity to ask questions about your values and the chance to receive feedback about your thinking and conclusions.

Here are some less good options:

> (not great) If a philosophy professor gives you a writing assignment in which you are asked to critically assess an idea from an assigned reading and ask generative AI to write your paper, then you have a special opportunity to engage with an expert and present them with your reasoning about a subject that could have a substantial impact on your life.

This *is* something they assert in the passage. But it's not the main point. (If it were, they could have just stopped after sentence two). The main point is instead about the

fact that you would *give up* this opportunity if you used generative AI.

> (not great) Using chatGPT to write a college paper is wrong, because you deprive yourself of an opportunity to ask questions about your values.

This *is* something Aylsworth and Castro argue elsewhere in the paper. But they don't argue in *this passage* that you have a duty to take these opportunities, and thus that depriving yourself of the opportunity is wrong.

6 | Extra Credit: Interacting with AI (up to 10 points)

Without special prompting, both Claude and ChatGPT get most, but not all, of the parts of Problem 1 correct.

For 5 or 10 points of extra credit, do one of the following:

1. for 5 points: first, have the AI chat bot go back and forth with a generative AI chat bot, guiding it until it gets all the answers correct. Explain to me in a paragraph or two what you did.
2. for 10 points: Come up with a prompt that, when given to an AI chat bot together with the questions, leads it to give all ten correct answers without you having to correct it (I've tried a little bit at this and haven't succeeded, but you may be better at prompt engineering than I). You are not allowed to tell the chat bot which answers are correct or not. For the full 10 points, your prompt should be a *generalizable* prompt: it should be instructions so that the chat bot could get the correct answers even on different but similar questions. Then (1) give me the full prompt and (2) explain a bit about how you generated it.

Please only submit one of these to me to grade (although it may be worth it for you to do both!). You can get more than 100 points total for the problem set.

The tricky part here is that if simply fed the problem statement, generative AIs seem to do one of two things:

1. It assumes you can rephrase sentences by adding letters, like rephrasing "The World Trade Center being 1,776 feet tall," or
2. It asserts that if you delete "being" from "The World Trade Center being 1,776 feet tall," you get "The World Trade Center is 1,776 feet tall" (this is not true: you had to add the "is."

Here is a prompt that gets the right answers. Curiously, I tried some prompts where I explained in more detail, and they sent the AI off the rails in other directions, sometimes even getting *more* wrong answers:

> Determine which of the following are statements. To do this, put "It is true that" at the beginning. If what results makes grammatical sense, then it is a statement. You can remove one or two words, but do NOT add any words.