



## Training Exercises PT2 (Deductive Arguments) with Example Solutions

### Issue 1: *At the Heart of Arguments*

(This issue is a modification of exercises in *Bowell/Kemp (2015)*.)

- (a) Write a message (e.g. in Signal) to a friend or a family member who has nothing to do with philosophy and briefly explain what the principle of charity is and why it is cool<sup>1</sup>. (Whether or not you want to send the message is of course up to you.)
- (b) Suppose that someone says that the main purpose of arguments is to defeat the opponent. Why is this wrong?
- (c) Mr. Smith says the following:

Mr. Jones argues that using SHA-1 is sufficient in our use case. However, as we have explained, Mr. Jones' argument is clearly invalid. Furthermore, we have shown that all the premises of the argument are false. Therefore, Mr. Jones is wrong. We can conclude that the use of SHA-1 is not sufficient for our use case.

Criticise Mr. Smith's argument.

### Sketch of a Solution 1:

- (a) 

Know that feeling when someone really dumb says something really ingenious without even noticing? 🤔 In Ethics for Nerds I heard of this really cool concept today: the principle of charity! 😊 Basically, it is that you always try to actively look for the ingenious (or at least moderately clever) interpretation of the stupid (or mediocre or clever or whatever) statement. Even if you think the other one is stupid. 🤔 I guess that's really hard if you are dealing with idiots, but I also think that you learn more from what others say and that conversation is smoother then. And it doesn't really hurt if you grant someone a good point that they did not mean to make, but it really hurts if you miss a great thought or an awesome conversation just because you were more nit-picky than necessary, right? 🤔

jetzt 🔄

- (b) While, arguably, some people see and use arguments as a sole means to defeat the opponent, an argument actually is a means to persuade someone (maybe even yourself) of its conclusion. The motivation behind this is to get closer to the truth.
- (c) Mr. Smith argues that the conclusion of Mr. Jones's argument has to be false if his argument for the conclusion is faulty. But this does not work: just because Mr. Jones gives a bad argument for

<sup>1</sup>If you have any doubts that the principle of charity is cool, come and discuss your view with us!

a conclusion, this does not mean that the conclusion is false. It just means that Mr. Jones should give a better argument for the conclusion if Mr. Smith and the others should be persuaded by Mr. Jones argument.

## Issue 2: *Tabular to logical form*

- (a) Bring the following arguments into their logical form
- (b) Are they valid?
- (c) Do you think they are sound? Why? Why not?

### **Argument:** Wet Ware

P1: If it rains, your computer is wet.

P2: Your computer is not wet.

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C: It does not rain.

### **Argument:** SQL Injections

P1: When you don't properly sanitize your inputs, your system can be attacked with SQL-injections.

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C: You should always properly sanitize your inputs.

### **Argument:** Social Engineering

P1: All systems are hackable.

P2: Even if systems are not connected to the internet, it is possible to hack them.

P3: One possibility to hack a system is to use social engineering.

P4: Social Engineering does not necessarily involve any attacks on the computer system itself, but rather uses psychological tricks to get access to the system.

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C: All systems are hackable.

### **Argument:** Hacking

P1: All computer systems can be hacked.

P2: If a computer system can be hacked, it can be manipulated.

P3: German systems for counting votes in elections are computer systems.

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C: The computer systems Germany uses for counting votes in elections can be manipulated.

### Sketch of a Solution 2:

- (a) The logical forms can look as follows:

**Argument:** Wet Ware

P1:  $a \rightarrow b$

P2:  $\neg b$

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C:  $\neg a$

**Argument:** SQL Injections

P1:  $a$

---

C:  $b$

**Argument:** Social Engineering

P1:  $a$

P2:  $b$

P3:  $c$

P4:  $d$

---

C:  $a$

**Argument:** Hacking

P1:  $\forall x. CSystem(x) \rightarrow hackable(x)$

P2:  $\forall x. CSystem(x) \rightarrow (hackable(x) \rightarrow manipulable(x))$

P3:  $CSystem(GerElectionCountingSystem)$

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C:  $manipulable(GerElectionCountingSystem)$

- (b) **Wet Ware** *Valid*: This is a Modus Tollens, which is valid.

**SQL injections** *Not valid*:  $b$  does not logically follow from  $a$ .

**Social Engineering** *Valid*:  $P1$  and  $C$  are identical, so the argument is valid.  $P2 - P3$  are simply irrelevant. Note however, that those kinds of arguments are bad (more on that later)!

**Hacking** *Valid*: From  $P1$  and  $P3$  you can derive  $hackable(GerElectionCountingSystem)$  and use that together with  $P3$  and  $P2$  to derive  $manipulable(GerElectionCountingSystem)$ , which is  $C$ .

### Issue 3: Tabular to logical form and back

In PT2, we briefly mentioned a method to make an argument in tabular form valid that already is *almost* valid:

1. Bring the argument into logical form. (And make sure that this is valid.)

2. Make a list with the names of all identifiers, predicates, constants etc.
3. Map each of the items on the list to the phrase in natural language that it stands for in the tabular argument.
4. Substitute everything in the logical form with your mappings exactly and word by word.
5. Substitute all the logical operators, quantifiers etc with their equivalent in natural language.
6. Make changes such that the sentences become grammatically correct, unambiguous and relatively easy to read. (You may also change certain phrases that sound very awkward to less awkward phrases, but make sure to pay very close attention that you do not destroy validity again. An example would be that you might write “all dogs” instead of “everything that is a dog”.) But if in doubt, better make less changes than ending up with an invalid argument.

(a) Make the following two arguments valid using this method:

**Argument: A**

- P1: Soon we will have autonomous cars that will be such that it is much less likely to cause an accident compared to a human driver in almost all instances.
- P2: In a short time it will be the case that we ought to allow certain autonomous cars, if we will have autonomous vehicles that will, in most cases, be a lot less prone to cause accidents than a human driver.
- 
- C: It will soon be true that we should allow autonomous vehicles with certain properties.

**Argument: B**

- P1: It is not rational to carry a bugging device with you.
- P2: Everything that has a microphone that can be switched on and send audio to a third party without the users knowledge or control is a bugging device.
- C1: Therefore, it is irrational to carry anything on you that has a microphone that can record and send audio to anyone without the owners control or knowledge. (P1, P2)
- P3: All Smartphones have microphones which can be tapped and used to send audio to a third party without your knowledge.
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- C: Therefore, it is irrational to have any smartphone on you. (C1, 3)

(b) You most likely saw that the method worked a lot better on argument A than on argument B. Why is that?

**Sketch of a Solution 3:**

(a) **Argument A:**

Logical form:

**Argument: A**P1:  $a$ P2:  $a \rightarrow b$ C:  $b$ 

Mapping:

identifier	natural-language phrase
$a$	“soon we will have autonomous cars that will that it is much less likely to cause an accident compared to a human driver in almost all instances”
$b$	“soon it will be the case that we ought to allow certain autonomous cars”

Result after mapping, substitution, and ‘grammarifying’:

**Argument: A**

P1: Soon we will have autonomous cars that will that it is much less likely to cause an accident compared to a human driver in almost all instances.

P2: If soon we will have autonomous cars that will that it is much less likely to cause an accident compared to a human driver in almost all instances, then soon it will be the case that we ought to allow certain autonomous cars.

C: Soon it will be the case that we ought to allow certain autonomous cars.

**Argument B:**

Logical form:

**Argument: B**P1:  $\forall x : isBD(x) \rightarrow \neg ratToCarry(x)$ P2:  $\forall x : hasEvilMic(x) \rightarrow isBD(x)$ C1:  $\forall x : hasEvilMic(x) \rightarrow \neg ratToCarry(x)$ P3:  $\forall x : isSP(x) \rightarrow hasEvilMic(x)$ C:  $\forall x : isSP(x) \rightarrow \neg ratToCarry(x)$ 

Mapping:

identifier	natural-language phrase
$isBD$	“is a bugging device”
$ratToCarry$	“is rational to carry with you”
$hasEvilMic$	“has a microphone that can be switched on and send audio to a third party without the users knowledge or control”
$isSP$	“is a smartphone”

Result after mapping, substitution, and ‘grammarifying’:

**Argument: B** – extremely strict (and not so good) variant

- P1: For everything it holds that if it is a bugging device, then it is not rational to carry it with you.
- P2: For everything it holds that if it has a microphone that can be switched on and send audio to a third party without the users knowledge or control, then it is a bugging device.
- C1: Therefore, for everything it holds that if it has a microphone that can be switched on and send audio to a third party without the users knowledge or control, then it is not rational to carry it with you. (P1, P2)
- P3: For everything it holds that if it is smartphone, then it has a microphone that can be switched on and send audio to a third party without the users knowledge or control.
- 
- C: Therefore, for everything it holds that if it is a smartphone, then it is not rational to carry it with you. (C1, 3)

**Argument: B** – slightly less strict (and better) variant

- P1: For everything that is a bugging device it is not rational to carry it with you.
- P2: Everything that has a microphone that can be switched on and send audio to a third party without the users knowledge or control is a bugging device.
- C1: Therefore, for everything that has a microphone that can be switched on and send audio to a third party without the users knowledge or control it is not rational to carry it with you. (P1, P2)
- P3: All smartphones have a microphone that can be switched on and send audio to a third party without the users knowledge or control.
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- C: Therefore, for everything that is a smartphone it is not rational to carry it with you. (C1, 3)

**Argument: B** – more elegant (and best) variant

- P1: It is not rational to carry any bugging device with you.
- P2: Everything that has a microphone that can be switched on and send audio to a third party without the users knowledge or control is a bugging device.
- C1: Therefore, it is not rational to carry anything with you that has a microphone that can be switched on and send audio to a third party without the users knowledge or control. (P1, P2)
- P3: All smartphones have a microphone that can be switched on and send audio to a third party without the users knowledge or control is a bugging device.
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- C: Therefore, it is not rational to carry any smartphone with you. (C1, 3)

- (b) Argument A uses propositional logic while argument B uses first-order predicate logic. The syntax of propositional logic is a lot closer to the syntax of our natural language than it is for first-order predicate logic. The syntax of  $\forall$  and  $\exists$  is very far away from how we quantify in natural language. This is why the process of reversing the logical form to the tabular form can get very hard. (It nevertheless is essential to get clear about the logical structure if one tries to make an argument valid or if one checks an argument for validity.)

**Issue 4: Your first valid argument in standard form**

On the last exercise sheet, you wrote arguments in standard form for or against each of the following claims or reasonable conditionalizations thereof.

- (I) Children under the age of 10 should not have a smartphone.
- (II) Every software should be open-source.
- (III) It should be obligatory for high-school students to learn at least a little bit of programming.

Revisit your standard forms and check them for validity. If they are not already valid, improve them such that they become valid.

**Issue 5: Mix and Match****Argument:** Logical Form 1P1:  $p \rightarrow q$ P2:  $q$ C:  $p$ **Argument:** Logical Form 2P1:  $\neg p \wedge \neg q$ P2:  $r \rightarrow \neg(p \vee q)$ C:  $\neg r$ **Argument:** Logical Form 3P1:  $(p \wedge q) \vee \neg q$ P2:  $\neg p$ C:  $\neg q$ **Argument:** Logical Form 4P1:  $p \rightarrow \neg q$ P2:  $q \vee s$ P3:  $\neg s$ C:  $\neg p$ **Argument:** Logical Form 5P1:  $Fa$ P2:  $\forall x : \neg G(x) \vee \neg F(x)$ C:  $\neg Ga$ **Argument:** Logical Form 6P1:  $\forall x : G(x)$ P2:  $(\forall x : F(x)) \rightarrow (\forall x : G(x))$ C:  $\forall x : F(x)$ **Argument:** Logical Form 7P1:  $\forall x : F(x)$ P2:  $\forall x : (G(x) \wedge F(x)) \rightarrow \neg F(x)$ C:  $\neg \exists x : G(x)$ **Argument:** Logical Form 8P1:  $\exists x : F(x) \wedge (F(x) \rightarrow \neg F(x))$ C:  $\forall x : G(x)$ 

(a) Which of the above arguments are valid, which are not valid?

(b) Which of the above logical forms match the following textual forms?

I “Neither are drones harmful, nor are they inherently bad. But only if they are harmful or they are inherently bad, we ought to restrict public access to them. Thus, we ought not to restrict public access to drones.”

II “If it rains, the street will be wet soon, and yes, it is raining. Thus, the street will be wet soon.”

- III “If autonomous cars will cause significantly less harm than the average human driver, we have moral reasons to permit them. But overall we shouldn’t permit autonomous cars. Thus, autonomous cars won’t cause significantly less harm than the average human driver.”
- IV “If it rains, the street will be wet soon. And, in fact, the street will be wet soon. Thus, it rains.”
- V “Socrates is a man. Obviously, some man are mortal. Thus, Socrates is mortal, too.”
- VI “Everything is red. But everything, that is red and a duck at the same time, is not red at all. Thus, there are no ducks.”
- VII “There is a true sentence for which it holds that if it is true, then it is false. Thus, all computer scientists are nerds.”
- VIII “If my coffee machine is broken, I have no coffee in the morning. I have coffee in the morning, or am I tiered all day. But today, I am not tired all day. Thus, my coffee machine is not broken.”
- IX “This argument is both funny and not funny. If this argument is valid, then a Mix-and-Match exercise has been part of every Ethics for Nerds exam so far. Thus, a Mix-and-Match exercise has been part of every Ethics for Nerds exam so far.”

### Sketch of a Solution 5:

- (a) **Valid** 3, 4, 5, 7, 8  
**Not valid** 1, 2, 6
- (b)
  - I No match. Almost matches 2, but not quite.
  - II No match. This is a Modus Ponens and there is no logical form for that above.
  - III No match. Tempting to think that it is a Modus Tollens, but “we have moral reasons to permit” and “overall we should permit” are two different things.
  - IV Matches 1.
  - V No match. Nothing even remotely close.
  - VI Matches 7.
  - VII Matches 8.
  - VIII Matches 4.
  - IX No match.

### Issue 6: *Why isn’t it valid?*

None of the following arguments is logically valid. What makes them logically invalid? How could you fix the problem?

#### Argument: Argument 1

- P1: If weakening the encryption was the right thing to do, then it would be right to accept possible misuse of the weakening.
  - P2: It is not right to accept possible misuse of the weakening.
- 
- C: Thus, we should not weaken the encryption.



**Argument:** Argument 2

P1: Encryption is not only used by criminals.

P2: Normal people, too, use encryption to secure their communication.

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C: We should neither forbid nor weaken encryption by law.

**Argument:** Argument 3

P1: If we weaken the encryption then it would be right to accept possible misuse of the weakening.

P2: It is not right to accept possible misuse of the weakening.

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C: We should not weaken the encryption.

**Argument:** Argument 4

P1: You could use spyware to monitor encrypted messages.

P2: I see that very critical.

---

C: If it is allowed then only by court order.

**Argument:** Argument 5

P1: If it is reasonable to monitor unencrypted communication channels on a case-by-case basis then it is reasonable to monitor encrypted communication channels on a case-by-case basis.

P2: It is rational to monitor unencrypted communication channels on a case-by-case basis.

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C: It is reasonable to monitor encrypted communication channels on a case-by-case basis.

**Argument:** Argument 6

P1: Surveillance is good for the security of Germany.

P2: There are two possibilities to monitor encrypted messages: deploy spyware on individual devices or weaken the encryption.

P3: Weakening the encryption is not a good idea because it allows possible misuse.

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C: We should allow deploying spyware.

**Sketch of a Solution 6:**

1. The wording in  $P1$  and  $C$  differs a little: “was the right thing to do” and “we should” here is meant to have the exact same meaning, but one should always keep the wording the same.
2. The premises are not connected at all, especially not logically. This argument is just a loose list of statements and far from valid.
3.  $P1$  says “If we weaken”, but  $C$  says “We should not weaken”. The “should” just appears out of thin air, which makes the argument invalid.
4. Just a loose list of statements.
5. Some words are changed.  $P1$  says “reasonable”, while  $P2$  says “rational”.
6. Just a loose list of statements again.

### Issue 7: *Playing with logical forms*

You are given the following logical form:

**Argument:**

P1:  $\exists x.P(x) \rightarrow \exists y.Q(y) \wedge R(y)$

P2:  $\forall x.Q(x) \rightarrow \neg R(x)$

P3:  $\exists x.Q(x)$

---

C:  $\neg \exists x.P(x)$

- (a) Is an argument with such a logical form valid?
- (b) Can you improve it?
- (c) Can you come up with a tabular form that has such a logical form?

### Sketch of a Solution 7:

- (a) Yes, it is.  $P2$  is equivalent to  $\neg \exists y.Q(y) \wedge R(y)$ . With that, you can derive from  $P1$  that  $\neg \exists x.P(x)$ , which is  $C$ .
- (b) For deriving  $C$ , you do not need  $P3$ . Thus, you can improve the argument by just throwing  $P3$  away.
- (c) A possibility would be filling the logical form like the following:

**Argument:** Unicorns

P1: If there is a unicorn, there is something that is a horse and has a horn.

P2: All horses have no horn.

P3: There are horses.

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C: There are no unicorns.

### Issue 8: *Own Arguments*

Come up with a sound argument for or against the following claims or a reasonable conditionalization thereof. Give soundness reasoning.

- (a) Script blockers help to keep a system secure.
- (b) Mark Zuckerberg should implement a system against filter bubbles in Facebook.
- (c) If autonomous cars are reasonably reliable, they ought to be introduced.

### Sketch of a Solution 8:

As an example, there is a sketch for the solution of (c):

#### Argument:

- P1: If autonomous cars are reasonably reliable, human drivers are more accident-prone than autonomous cars.
- P2: If human drivers are more accident-prone than autonomous cars, human drivers are more likely to do harm than autonomous cars.
- P3: There are a lot of cars in the world.
- P4: If there are a lot of cars in the world and human drivers are more likely to do harm than autonomous cars, a lot of harm likely can be prevented with the introduction of autonomous cars.
- P5: If a lot of harm likely can be prevented with the introduction of autonomous cars, autonomous cars ought to be introduced.
- 
- C: If autonomous cars are reasonably reliable, they ought to be introduced.

Logical Form:

#### Argument:

- P1:  $a \rightarrow b$
- P2:  $b \rightarrow c$
- P3:  $d$
- P4:  $d \wedge c \rightarrow e$
- P5:  $e \rightarrow f$
- 
- C:  $a \rightarrow f$

This is valid. We know look a reasons to believe in the premises:

- P1: This was shown in a lot of ways, since autonomous cars can react faster than humans, do not get tired, drunk or ill and cannot be distracted.
- P2: As accidents cause harm, being more likely to cause accidents includes being more likely to cause harm.
- P3: Contingent truth, that can be checked easily.
- P4: If there are lots of cars, that are driven by humans, there is a lot of potential harm that can be prevented by introducing autonomous cars. This harm cannot be prevented without the introduction of autonomous cars.
- P5: It is plausible to assume, that one ought to do what is likely to prevent a lot of harm. Consequentialist theories would agree with that.

### Issue 9: *Soundness, again*

Check the soundness of this argument:

#### Argument:

- P1: If there is a person who is overall harmed by a technology, it is not allowed to introduce this technology.
- P2: A person is overall harmed by a technology if they were overall better off without the introduction of the technology.
- P3: Some people are overall better off without autonomous cars.
- 
- C: It is not allowed to introduce autonomous cars.

### Sketch of a Solution 9:

P1 is false. Therefore, the argument is not sound.

Why P1 is false: If the technology is extremely beneficial to a large number of people, but there are nevertheless a very few who are harmed by it, it does not thereby become forbidden to introduce this technology. Examples here are seatbelts, x-ray machines, and computers – basically any technology that is used at a large scale and has at least some impact.