THINKING CRITICALLY – WORKSHEET 2
LOGICAL ARGUMENTS

Some questions WILL require the Internet. The Internet is a supplement to, not a substitute for, your brain.

Part I: A Pattern To What People Say

Start by watching the following Youtube videos: Critical Thinking Part 1 and 2, by techNyouvids.

Vocabulary: In an academic sense, an argument is what someone uses to support an idea. Not a shouting match. Arguments are made up of a set of premises (or assumptions) and a conclusion, but logic is in there, somewhere. Everything that anyone thinks they "know" to be true or false, they learned by making or hearing some argument. This just means, we have reasons why we think we know things. Often it's not an explicit or even a good argument. Bad arguments are often called "rationalizations". To know something, we need to be able to personally argue it, well (recall: knowledge is a well-justified, true, belief).

1. Use the Internet (properly, like we discussed) and briefly describe these three concepts related to an argument, AS SIMPLY AS YOU CAN (find multiple sources with different phrasings so you can write them in your own words):
   - Assumptions/Premises: **THINGS YOU TENTATIVELY CONSIDER TRUE FOR THE ARGUMENT, AT LEAST**
   - Logic: **CHAIN OF REASONING AND ARGUMENT STRUCTURE**
   - Conclusion: **WHAT YOU ARGUE IS TRUE OR PROBABLY TRUE**

People almost never state their full argument. Figuring out people's hidden assumptions and logic is the key to thinking critically.

2. If you think someone's argument is wrong, how would you analyze or investigate each of the three "parts"?

   ASSUMPTIONS ARE LIKELY EMPIRICAL OR THE RESULT OF ANOTHER ARGUMENT. LOGIC TAKES THINKING ABOUT. CONCLUSIONS COULD EITHER BE REASONED OR LOOKED UP.

3. **Vocabulary:** Use the Internet (properly, like we discussed) to define deductive reasoning. We will define inductive reasoning as something like "good logical inference, which is not deductive".

With deductive arguments, if the premises are true and the logic is good, the conclusion is GUARANTEED!

- If inductive reasoning is not deductive, what does that imply about the certainty of the conclusion?

With inductive arguments, if the premises are true and the logic is good, the argument just adds support for the conclusion: it just makes the conclusion more likely than without the argument.

- **Inductive reasoning (aka inductive logic, or inference) really contains many different types. The term is also related to ampliative reasoning. We will just gloss over all these differences.**

Vocabulary: Deductive arguments, specifically, use some extra terminology:

- Good logic is called valid. If the premises are true and the logic is valid, the argument is said to be sound, and this means the conclusion MUST be true – it is guaranteed! You may ask, "how can we have something guaranteed to be true when we just said nothing is guaranteed?". In reality, the conclusion of a deductive argument is only guaranteed IF we can show the premises and logic are true and valid. These seem to always take inductive arguments to show, which cannot be guaranteed.

4. Test your understanding of validity, soundness, truthiness, and arguments: for each of the three statements below, say whether it is possible for the assumptions, logic, and conclusions to be true, if that statement is true. Assume all statements refer to deductive arguments.

    a) "Your logic is invalid." b) "Your argument is unsound." c) "Your conclusion is false."

A. THE LOGIC IS FLAWED, BUT THE ASSUMPTIONS AND CONCLUSION COULD STILL BE TRUE.

B. EITHER THE LOGIC IS INVALID, THE ASSUMPTIONS ARE FALSE, OR BOTH. THE CONCLUSION COULD STILL BE TRUE.

C. THIS MEANS, FOR DEDUCTIVE LOGIC, THAT THE ARGUMENT MUST BE UNSOUND IN SOME WAY.

SEE: FALLACY FALLACY

The following are variations on some basic structures in logic (modus ponens, and modus tollens). Don't worry: we will NOT be covering logic in depth. **Think of all logical possibilities to answer these – think: what can I really, definitely conclude?**

5. Premises: 1) If Billy eats the stinky sandwich, then Billy will get sick. 2) Billy ate the stinky sandwich.
    a. As long as the premises are true, what can you conclude?

    BILLY EITHER GOT SICK OR WILL GET SICK (SOON - IMPLIED)

    b. Does this involve deductive or inductive logic?

    THIS IS DEDUCTIVE LOGIC. THE CONCLUSION IS AS TRUE AS THE ASSUMPTIONS.

6. Premises: 1) If Billy eats the stinky sandwich, then Billy will get sick. 2) Billy didn't eat the stinky sandwich.
    a. As long as the premises are true, what can you conclude?

BILLY IS (AS OR) LESS LIKELY TO GET (OR HAVE GOTTEN) SICK THAN WITHOUT THE ARGUMENT.

    b. Does this involve deductive or inductive logic?

INDUCTIVE, INVOLVES PROB'S. THIS IS PROVABLE. CANNOT SAY THAT BILLY WILL NOT GET SICK.

7. Premises: 1) If Billy eats the stinky sandwich, then Billy will get sick. 2) Billy got sick.
    a. As long as the premises are true, what can you conclude?

IT IS (AS OR) MORE LIKELY BILLY ATE THE STINKY SANDWICH THAN BEFORE LEARNING HE GOT SICK.

    b. Does this involve deductive or inductive logic?

INDUCTIVE, INVOLVES PROB'S. THIS IS PROVABLE. CANNOT SAY BILLY ATE STINKY SANDWICH.

8. Premises: 1) If Billy eats the stinky sandwich, then Billy will get sick. 2) Billy didn't get sick.
    a. As long as the premises are true, what can you conclude?

BILLY DID NOT EAT THE STINKY SANDWICH.

    b. Does this involve deductive or inductive logic?

DEDUCTIVE. THE CONCLUSION IS AS TRUE AS THE ASSUMPTIONS.

9. Premises: 1) If Billy eats the stinky sandwich, then Billy will probably get sick. 2) Billy didn't get sick.
    a. As long as the premises are true, what can you conclude?

IT'S LESS LIKELY THAT BILLY ATE THE SANDWICH THAN BEFORE LEARNING HE DIDN'T GET SICK.

    b. Does this involve deductive or inductive logic?

INDUCTIVE, INVOLVES PROB'S. CAN'T SAY HE PROBABLY DIDN'T EAT THE SANDWICH: PROB #S MATTER.

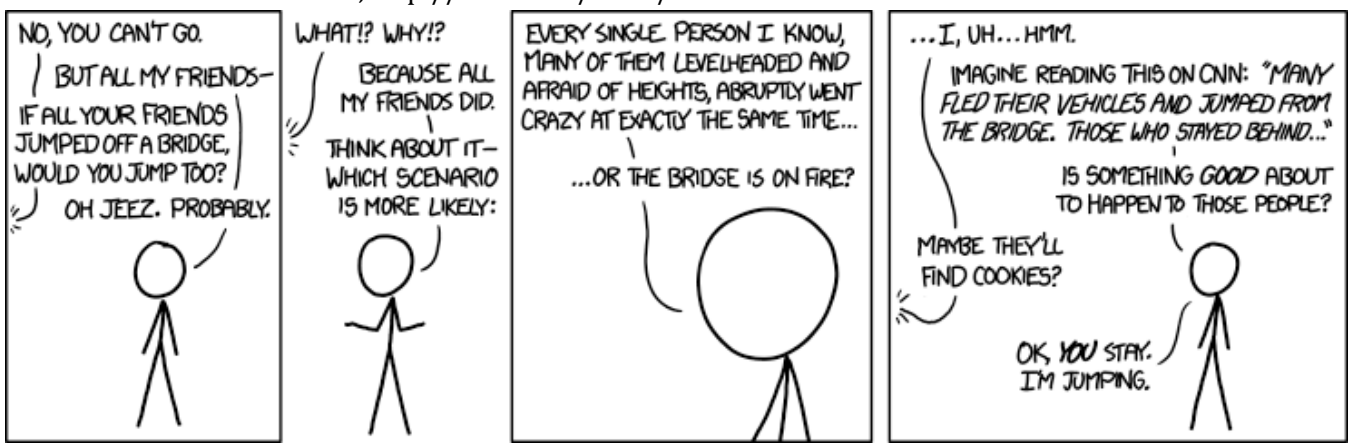
Part II: How logic and arguments fail

Logical fallacies and cognitive biases are related concepts. Logical fallacies come in two types, formal and informal. Informal fallacies only show the argument is flawed when it is used in an absolute (deductive) sense, but may be reasonable if used more loosely (inductively).

Take the argument from popularity logical fallacy:

"All your friends are jumping off bridges, so it must be a good idea; you should do it, too."

This is clearly false because it is stated in absolute terms. If we state it more loosely, it becomes more reasonable. From xkcd comics, http://xkcd.com/1170/:



List of Fallacies and Cognitive Biases

Fill in the missing entries/descriptions/examples. When adding an entry, focus mostly on INFORMAL fallacies.

This list is for your reference so pick the fallacies that seem the most useful to you, when filling them out.

1. **Non-sequitur**:
   - Description: This means "does not follow" – this is the most generic term for a logical fallacy. Only use this if no others are appropriate. This is best used when two statements are completely unrelated.

   - Example: "I was born in 1983, therefore the sky is blue."
     - Being born in 1983 has nothing to do with the sky being blue.

2. **Dunning-Kruger effect (cognitive bias):**
   - Description: People more competent in a subject tend to rate themselves as less competent. People less competent in a subject tend to rate themselves as more competent.

   - Example: ***Some anti-vaxers think they understand the issues better than the consensus of doctors. *Some people think climate scientists haven't thought that warming could be a natural trend.**

3. **Fallacy fallacy (aka Argument from fallacy):**
   - Description: **Thinking that because the argument was unsound in some way, the conclusion it tried to reach must be false. A different argument could soundly prove the conclusion true.**

   - Example: Billy: "I was born in 1983, therefore the sky is blue." George: "Since Billy's argument contains the non-sequitur logical fallacy, the logic is invalid. Since the logic is invalid, the sky must not be blue."

   ❖ Noticing a bad argument can convince us that the conclusion is false, even though it shouldn't. Philosopher Daniel Dennett had this to say: "There's nothing I like less than bad arguments for a view that I hold dear."

4. **False choice:**
   - Description: **A statement implying a limited (often 2 – false dichotomy) number of choices when there really are more, or even a spectrum (infinite number) of choices.**

   - Examples: 1) There are two kinds of people in this world, thinkers and doers.
     2) A husband says, "I always put the toilet seat down." His wife says, "You never put the toilet seat down." Either the husband is wrong or the wife is wrong.
5. **Straw man:**
   - Description: **Attacking a weaker (easier to attack) argument that who you're arguing with does not hold. Origin unclear but analogous to a soldier knocking down a straw man with a bayonet.**

   - Example: **A) We should advance some reasonable gun control measures.**
     B) No, taking everyone's guns away is against the 2nd amendment.

   ❖ Owen's recommendation: use the opposite tactic, called the **principle of charity**: which means to examine an argument in the best light, first: give the arguer the "benefit of the doubt".
6. **Ad hominem:**
   - Description: **"At the person": Directing an attack against an unrelated part of a person's character rather than the argument they put forward.**

   - Example: **Melissa Robinson) You're just mad because your stupid pebble theory didn't work out and you don't know how to express your anger.**
     Ace Ventura) Yeah, well you're ugly.

7. **Argument from authority:**
   - Description: **Saying because a person is an authority they must be correct. Authorities make mistakes, especially outside of their field.**
   - Example: **"As Lord Kelvin is the highest authority in science now living, I think we must yield to him and accept his view." –Mark Twain on the Kelvin's 20 Myr estimate of the age of the Earth.**

   ***Multiple lines of evidence conflicted here. Don't assume science is likely wrong w/o such a conflict.**
   ****Note that convection of heat from the core to the surface leads to a ~few Gyr age since it keeps the surface heat flux at high levels, close to current values, for longer. Radioactivity is not the major error, for the Earth but nuclear phenomena do cause the error for the age of the Sun.***
8. **Confirmation bias:**
   - Description: **All of our tendency to (subconsciously) try to confirm what we already believe, rather than find the truth, whatever it is. Similar: our tendency to believe/confirm what we WANT to be true.**
   - Example: **When shown evidence they are wrong, conspiracy theorists of many kinds (JFK, moon landing, 9/11, etc.) just assume the evidence was faked by the conspiracy than admit they might be wrong.** (Add more fallacies/biases from here on)
9. CHERRY PICKING (Selection Bias)
   - Description: **Using a piece of evidence to support your claim but ignoring contrary evidence.**

   - Example: **Publication bias.**

10. TEXAS SHARPSHOOTER FALLACY
    - Description: **Establishing the criteria for success after you've already seen the results, and in a way that those results become what is successful.**

    - Example: **Shooting a particular of many cans and then saying that's the one you wanted to hit.**

11. CIRCULAR REASONING (Begging the Question/Tautology/No True Scotsman)
    - Description: **Assuming what you are trying to prove/conclude.**
    - Example: **No True Scotsman: A) "All Scotsmen are brave". B) "Bort is a Scotsman and he's a coward." A) "Then he's not a TRUE Scotsman!"**
12. TOUPEE FALLACY
    - Description: **A fallacy involving unobserved/unobservable evidence that could contradict the conclusion.**
    - Example: ***I can always tell a toupee when I see one. (If they see one so good they don't notice, they'll never know they were wrong. *I can always tell when someone's lying!**
13. DENYING THE ANTECEDENT (formal fallacy)
    - Description: **Thinking that IF (If A is true, then B is true) is true, THEN (If A is NOT true, then B is NOT true) is true, too.**
    - Example: **If Billy jumps, then he will die. Billy did not jump ➔ Therefore Billy did not die.**
14. AFFIRMING THE CONSEQUENT (formal fallacy)
    - Description: **Thinking that IF (If A is true, then B is true) is true, THEN (If B is true, then A is true) is true, too.**
    - Example: **If Billy jumps, then he will die. Billy died ➔ Therefore Billy jumped.**
15. FALLACY OF TRANSPOSED CONDITIONALS (example of Abuse of Statistics)
    - Description: **Confusing P(A | B) and P(B | A). Inductive (probabilistic) version of Affirming the Consequent (sort of).**
    - Example: **How people often misinterpret a p-value, which is the probability of a result as or more extreme than what's measured given the null hypothesis being true (subset of the hypothesis being false). This is confused with the probability of the hypothesis being false given such extreme data.**
16. BASE RATE FALLACY (example of Abuse of Statistics)
    - Description: **Failing to consider how common something is in the background.**
    - Example: ***Hearing hooves stomping behind you and assuming it's a zebra because it sounds more like those than horse hoof-stomps. *Diagnosing a rare disease only because the symptoms fit better. *Assuming a UFO means aliens because it doesn't look like something you recognize.**
17. LOTTERY FALLACY (example of Abuse of Statistics)
    - Description: **Focusing on the unlikely chances that a specific event occurs but ignoring that many similar draws from that distribution have been made where the specific event did not occur. This seems to be an example of the Base Rate Fallacy.**
    - Example: ***"The chances of me winning the lottery are miniscule, so I must have been destined to win!" but SOMEBODY will probably win the lottery every week. *"The chances of me surviving this cancer were 1/1000 but I did, so it was a miracle!" ignoring that 999 other people with the same cancer die for every person like them that survives and SOMEONE is that lucky person.**
18. GAMBLER'S FALLACY
    - Description: **Thinking a streak of outcomes of a random process means a different outcome is more likely afterward, often saying that different outcome "is due" to occur.**
    - Example: **It's landed on heads 4 times, now; tails is due to come up! *Opposite of the possibly mistaken "Hot Hands Effect": when a streak (say of sunk baskets) is really due to our mistaken intuition on randomness.**

19. HOUSE MONEY EFFECT
    - Description: **A bias where a gambler makes riskier decisions when they happen to have won more than lost, not realizing they could/will soon regress to the mean and lose in the long run.**
    - Example: **I was supposed to die of cancer, so now I can do whatever I want because it's all gravy from here.**

20. SUNK COST FALLACY
    - Description: **Following through with something when you can't get back what you invested into it and don't actually want to follow through with it (usually because you invested a lot to get there).**
    - Example: **We'd better go to this stupid movie because the ticket is non-refundable.**

21. HASTY GENERALIZATION
    - Description: **Thinking some quality in a small dataset means that's also true in general.**
    - Example: ***That person who almost swerved into me was a woman; therefore all women are bad drivers.**

22. CONFUSING CORRELATION WITH CAUSATION (example of an Abuse of Statistics)
    - Description: **Thinking that because two things trend with or against each other that one thing causes the other.**
    - Example: ***Atkins dieters lose weight therefore its cutting carbs that helps. Those studies don't control for just eating less. *My child was diagnosed with autism after having vaccines, therefore the vaccine caused the autism (see Post Hoc Ergo Propter Hoc).**

23. POST-HOC ERGO PROPTER HOC (After this, therefore because of this)
    - Description: **Thinking that because event A preceded event B, event A must have CAUSED event B. Type of (temporal) correlation v. causation mix-up.**
    - Example: ***I survived an accident without a seatbelt, therefore I'm never wearing a seatbelt again! (Assumes the lack of seatbelt helped them survive.) *My child was diagnosed with autism after having vaccines, therefore the vaccine caused the autism (see Post Hoc Ergo Propter Hoc).**

24. POISONING THE WELL
    - Description: **Less explicit of Ad Hominem. Just hinting that someone's argument is bad because of a negative character trait.**
    - Example: **Rob Lowe's Direct TV commercials. "I'm Meathead Rob Lowe and I have cable."**

25. APPEAL TO POPULARITY (BANDWAGON FALLACY)
    - Description: **Because something is popular it must be correct.**
    - Example: **Everybody watches sports so it must be correct.**

26. ARGUMENT FROM IGNORANCE
    - Description: **Because we don't know something, thinking that any old idea can be assumed correct. *Confusing unexplained with unexplainable.**
    - Example: ***This UFO is unidentified so it must be aliens. *God of the gaps is an example.**

27. ARGUMENT FROM PERSONAL INCREDULITY

- Description: **Something must be false because the arguer can't believe it is true; doesn't support their disbelief with reasons.**

- Example: ***I can't imagine why or how people could fake circles in wheat/corn fields so it must be aliens because they're unfathomable. *"OH YEAH?!"**

28. APPEAL TO EMOTION
    - Description: **Using emotion to support one's argument or deny another.**

    - Example: **Sure scientists have observed fruit flies to speciate (splitting, "macroevolution" of new species) but those new fruit flies were all *MUTATED*!**

29. APPEAL TO NATURE
    - Description: **Because something is natural it must be good, or unnatural so it must be bad.**

    - Example: **Herbal supplements rely on this. Nature does serve humans. Plants evolve traits because those survive better than other traits: it's for their own survival (really the genes').**

30. ARGUMENT FROM ANTIQUITY (similar to Genetic Fallacy)
    - Description: **Because something has been around a long time it must be good.**

    - Example: **This is the best way to do it because it's tradition, or because it's passed down through the ages.**

31. ARGUMENT FROM FINAL CONSEQUENCES (Appeal to Consequences)
    - Description: **Thinking an argument is either true or false because its conclusion is either desirable or undesirable. This is also an Appeal to Emotion.**

    - Example: ***Evolutionary theory must be false because it would mean we came from monkeys.**

32. APPEAL TO MODERATION (Fallacy of the mean)
    - Description: **Thinking the middle-ground of any two conflicting views must be correct.**

    - Example: ***Republicans and Democrats must both be equally wrong.**

33. NIRVANA FALLACY (special case of False Choice)
    - Description: **If something falls short of a perfect/ideal solution it is worthless.**

    - Example: ***Thinking that anything less than directly confronting someone (say by using a note) is passive aggressive, when really either saying nothing but secretly hating or undercutting the person is passive aggressive behavior. *If conventional medicine can't guarantee a cure for my cancer, I'm using alternative medicine. *Never go to Wikipedia because anyone can write that stuff: too strict definition of "reliable".**
34. FALSE ANALOGY (also a False False Analogy)
    - Description: **Using an inappropriate analogous situation to support your view, where the quality in common is immaterial to the point. (False False Analogy – false attribution of False Analogy fallacy: no analogy between two things is a perfect match, that's why they're not identical.)**

- Example: ***Reductio ad Hitlerum: My opponent likes breakfast. You know who else liked breakfast? Hitler!**

35. SLIPPERY SLOPE FALLACY (misuse of the legitimate argument)
    - Description: **Saying event A will lead to some undesirable event B without supporting the connection.**

    - Example: ***If we pass reasonable gun control, soon they'll outlaw all guns! *If we allow reasonable abortion rights, soon they'll be doing late term abortions!**

36. SPECTRUM FALLACY (False Continuum)
    - Description: **Thinking because something is a spectrum we cannot reasonably talk about the two ends as being meaningful.**

    - Example: **The major position of post-modernism: because absolute proof doesn't exist, nothing can be reasonably knowable as true or false!**

37. MOVING THE GOALPOST
    - Description: **Setting a more and more stringent and unreasonable standard of success/proof as evidence is presented to meet the previous standards.**

    - Example: ***Declaring the filled gaps made by chains of transitional fossils is not enough because more gaps persist. More gaps will ALWAYS persist.**

38. RED HERRING
    - Description: **An unrelated argument that distracts from the issue.**

    - Example: ***An ad hominem attack serves this purpose.**

39. FALLACY OF RELATIVE PRIVATION
    - Description: **Dismissing an argument because more important issues exist in the world.**

    - Example: ***How can you worry about your food poisoning when there are people starving elsewhere in the world.**

40. MORAL HIGH GROUND
    - Description: **Taking a "holier than thou" stance to appear like you're winning the argument.**

    - Example: ***No matter what you say, I experience the joy from my religious faith.**

41.
    - Description:

    - Example:

42.

- Description:

- Example:

Part III: Name that logical fallacy – Put what you learned to the test

IF THERE IS ONE, identify the specific fallacies or cognitive biases (there may be more than one fallacy or bias, and some are not included on the list of fallacies and cognitive biases I provided, below).

1. "You're either with me or you're against me."

FALSE CHOICE – Could be neutral or partly with, etc.

2. "How can she be a competent office manager when she voted for Obama?!"

POSSIBLY AD HOMINEM, BUT SIMILAR ARGUMENTS COULD BE LEGITIMATE COMMENT ON CHARACTER

3. "He must be correct, he has a British accent!"

ARGUMENT FROM A (SILLY) AUTHORITY, NON-SEQUITUR

4. "Scientists say the climate is warming, but what do they know?! It's snowing outside!"

HASTY GENERALIZATION (CHERRY PICKING), STRAW MAN

5. "The flu vaccine is only 51% effective at preventing the flu, so it's basically worthless."

NIRVANA FALLACY

6. Republicans and Democrats are both wrong about some things; so, the best political view to have is an even compromise between both sides.

APPEAL TO MODERATION

7. Only talking to other people that share your views contributes to what bias?

CONFIRMATION BIAS

8. Racist and sexist views are often started or exacerbated by what fallacies and/or biases?

HASTY GENERALIZATION, AND CONFIRMATION BIAS

9. Many superstitions are formed by what fallacies and/or biases?

CORRELATION V. CAUSATION (ESP. POST-HOC ERGO PROPTER HOC), AND CONFIRMATION BIAS

10. Be prepared to discuss the following claim as a class: "Wikipedia is a good resource."

DEPENDS WHAT YOU MEAN BY GOOD, FOR WHAT MATERIAL, AND FOR WHAT PURPOSE. MOST TEACHERS SAY "NO", BUT IS IT RELIABLE - FOR SCIENCE QUESTIONS IT IS AS RELIABLE AS ENCYCLOPEDIA BRITANICA AND MORE UPDATED. IT HAD THE BEST DEFINITIONS OF KNOWLEDGE, INDUCTIVE, REASONING, ETC. IS THE STATEMENT GUARANTEED TRUE? NO, BUT NOTHING IS. IS IT MORE LIKELY WRONG THAN OTHER SOURCES, WELL IT DOESN'T SEEM SO FOR SCIENCE, BUT MAYBE FOR OTHER SUBJECTS. IF SOMEONE SAYS "BUT ANYONE CAN CHANGE IT", THEY COULD BE PUTTING TOO MUCH RELIANCE ON SOME OTHER AUTHOR AS AN AUTHORITY. MANY, MANY BOOKS ARE WRONG. ARE THEY MORE LIKELY CORRECT THAN WIKIPEDIA? IT PROBABLY DEPENDS ON THE SUBJECT.