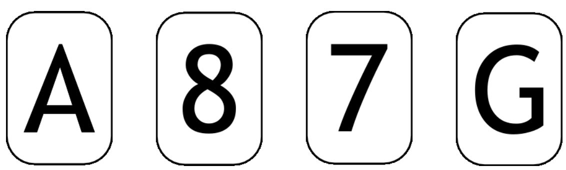
Philosophy 20100/30000
Elementary Logic
Autumn 2006
Problem set 1

Instructor: Jason Bridges

- † This problem set is due on Thursday, Oct. 12, at the beginning of class.
- † Either type your work or write it neatly and legibly. (Information for producing the logical symbols in Microsoft Word can be found on the course's Chalk website in the Assignments folder.) *Any writing that takes effort to decipher will be marked incorrect, with no possibility of a do-over.*
- † Problems marked with check marks ("✓") are practice problems. It is strongly advised that you do them, *but don't turn your work on them in.* Answers to these problems will be made available on the course's Chalk web site.
- † Problems marked with bullets ("•") are extra-credit problems. Most are designed to give a taste of concepts and topics outside the boundary of this course. Some are pretty tough.
- † Throughout, *DL* stands for Goldfarb's *Deductive Logic*.

1. **Conditionals.** Experimental psychologists have established that the great majority of people get the following problem wrong. Show that you've already learned something in this class by getting it right.

   The following four cards have a letter on one side and a number on the other. (Two of the cards have the letter side visible, and two have the number side visible.)



   Indicate which of the cards you must turn over in order to determine whether the following conditional is true:

   If a card has a consonant on one side, it has an odd number on the other side.

2. **Paraphrase.** Using the logical notation we've learned, paraphrase the following as fully as possible.

   ✓(a) Mackenzie is friends with either Wyatt or Chase but not both.
   (b) Alexis and Alexa are children and quite a pair.
   (c) Neither Alyssa nor Ava can read, write, or sit still.
   ✓(d) If either Destiny or Trinity tries out for the soccer team, then it's not the case that both Autumn and Summer will make the cut.

✓(e) Kylie doesn't come inside unless Kaylee or Katelyn tells her to.

(f) Caden will go to the party, and Aiden will not, if either Brayden or both Jayden and Hayden do.

(g) If Brooke and Xavier like each other, then either they both like Mia and Jackson, or neither likes either.

•(h) Madison will go to the party if Brooklyn or Jordan does, but only if Savannah does not.

(i) Although all of the names used in these sentences were among the 100 most popular U.S. boys' and girls' baby names for 2005, few will be popular in 2015.

3. **Negation.** Do problem 1 on p. 253 of *DL*. Make sure your sentences are unambiguous. (b) is a practice problem; (a) and (c) are to be turned in; skip (d) and (e) and substitute the following:

   (d) Vanessa wants to eat a muffin and drink some coffee.

4. **More paraphrase.** More paraphrase.

   (a) Michael and Fredo will not both leave the Corleone family business, and one will kill the other.

   ✓(b) Assuming Carlo does his part and Connie calls Sonny, and assuming as well that he gets her phone call at the proper time, Sonny will meet his doom.

   (c) Connie says Michael killed Carlo though Michael denies it, and Kay believes Michael only if she's deceiving herself.

   ✓(d) Sollozzo controls either Tessio or Clemenza, and so provided that Barzini doesn't tip off either Tom or Sonny, Luca Brasi sleeps with the fishes.

   (e) If the meeting is set up and Tessio assumes a key role, then he (and not Clemenza) betrayed Michael and he won't survive the night unless Tom intervenes.

   (f) At least two of the following people—Moe Green, Tessio and Johnny Fontane—are untrustworthy, and exactly two of them will be offed.

5. **Informal explanations of equivalence.** Do problem 3. on p. 254 of *DL*.

6. **Truth tables.** Calculate, in full form, truth-tables for the following. If you use the space-saving measure described on pp. 43-44 of *DL*, make sure it's clear which line of the truth table is the final answer.

   ✓(a) $(p \vee q) \supset p$

   (b) $(p \supset \neg p) \cdot p$

   ✓(c) $(p \supset (q \supset r)) \cdot ((p \supset q) \supset r)$

   (d) $p \vee \neg\neg(r \cdot (q \supset \neg(p \vee r)))$

(e) $\neg((p \equiv r) \equiv q) \supset (r \vee \neg s)$

•7. **Polish notation.** A *binary* (a.k.a. *two-place*) connective such as "$\cdot$" or "$\vee$" joins with two schemata to form a new schema. In our logical notation, the connective is placed between these two schemata. In *Polish notation* (so named because it was invented by the Polish logician Łukasiewicz) the connective is placed before the two schemata. Thus "$p \vee q$" becomes "$\vee\, p\, q$", "$p \vee \neg q$" becomes "$\vee\, p \neg q$", and "$p \vee (q \supset r)$" becomes "$\vee\, p \supset q\, r$". The advantage of Polish notation is that it does not require parentheses to avoid ambiguity. Whereas in our notation we use parentheses to distinguish "$p \vee (q \cdot r)$" from "$(p \vee q) \cdot r$", in Polish notation the former is "$\vee\, p \cdot q\, r$" (or, equivalently, "$\vee \cdot q\, r\, p$") and the latter "$\cdot \vee p\, q\, r$" (or, equivalently, "$\cdot\, r \vee p\, q$").' And whereas we need parentheses to distinguish "$(\neg p) \vee q$" from "$\neg(p \vee q)$", in Polish notation the former is "$\vee \neg p\, q$" and the latter "$\neg \vee p\, q$". For this and related reasons, programming languages and scientific calculators sometimes use Polish notation (actually, something called "reverse Polish notation").

(a) Translate the following schemata from our notation into Polish notation.

•i. $\neg(\neg p \vee q)$

•ii. $\neg(p \cdot q) \supset (\neg r \supset (s \cdot t))$

(b) Translate the following from Polish notation into our notation.

•i. $\equiv \equiv p\, q \equiv \neg p \neg q$

•ii. $\supset \supset p \supset q\, r \supset \neg \vee r\, s \neg t$