

Problem Set 1
Due in Class, Session 6

1. In the matrix below, each coefficient a_{ij} refers to the number of units of product j produced in country i in one person-day of labor.

	Shoes	Wheat
U.S.	4	6
Spain	2	2

- (a) Assume both economies are at full employment so that producing more of one good requires reallocating labor from the other good. In a world without trade, if the U.S. wants four more shoes, how many bushels of wheat will it have to give up? If Spain wants four more shoes, how many bushels of wheat will it have to give up?

The U.S. has to give up 6 bushels of wheat if it wants for more shoes (because both require a person-day of labor). If Spain wants 4 more shoes, it has to give up 4 bushels of wheat.

- (b) Calculate a trade proposal in which the U.S. offers X bushels of wheat to Spain in exchange for 4 shoes. Your calculated offer should be such that the U.S. loss of wheat is less than if it produced the 4 extra shoes domestically and that Spain is left with at least as many shoes and at least as much wheat as it had before trade—i.e. both countries are better off.

For Spain to produce 4 shoes it will cost it 4 bushels of wheat, so the U.S. must offer at least 4 bushels of wheat to make Spain at least indifferent to trade. However, the U.S. itself can get 4 more shoes if it pays 6 bushels of wheat (to itself). So, if the U.S. offers 5 bushels of wheat in exchange for 4 shoes, both countries are better off.

- (c) In the spirit of the Simon chapter, develop a parallel example where humans and machines take the place of the U.S. and Spain and show how specialization increases total output in the economy.

Notice that in this example, a U.S. worker is better at producing shoes *and* wheat than a Spanish worker (i.e. the U.S. has an “absolute advantage” in both sectors). However, the U.S. is better off if it concentrates on wheat production and lets Spain take over shoe production, i.e. there are gains from specialization

combined with trade. This is because of the principal of “comparative advantage”: how much of one good you need to give up in order to get one unit of another good. As long as there are two people with different comparative advantages, they will have gains if they decide to specialize and trade with each other.

In the context of the Simon chapter, the analogous argument is that even if computers gain absolute advantage (i.e. even if they are able to perform all tasks more efficiently than humans), there still will be gains from trade (which, in this case, involves humans performing some tasks and computers performing others). It is not the case that computers will be performing all the tasks and humans will be totally unemployed; instead there will be a pattern of specialization (according to comparative advantage), which will increase total output in the economy.

2. In Table 2 of Alan Krueger’s article “Have Computers Changed the Wage Structure?” he shows that, after controlling for the effects of age, education, etc., persons who work with a computer earn a premium of about .18 in the natural log of their wage (the dependent variable of the regression). This translates into about a 20% premium in their actual wage.

(a) How would the advertising people who develop Dell commercials like to interpret this coefficient?

The Dell people would like to interpret the coefficient as “Working with a computer will raise your wages by 20%”, i.e. if anyone went out and bought a computer, he would automatically see his raises go up by 20%.

(b) Give several reasons why the Dell interpretation in (a) may be wrong.

There are a number of reasons why it may be wrong. The people who work with computers may be smarter, more motivated and be of higher ability than those who do not and so would have earned higher wages anyway (even if they didn’t use the computer). Computers may be used only in higher-paying industries (e.g. financial services) or higher paying jobs within industries (e.g. manager vs. factory worker). Also, the people in the data who use computers may be precisely those people for whom computers are a complement rather than a substitute.

(c) Explain why, in Table 2, the coefficient on “uses computer at work” drops in value from .276 (in column 1) to .17 (in column 2) when controlling for things like education, experience, gender, etc.

In Column 1, the computer variable is getting all of the credit for the effect of the controls which are added in Column 2, so the effect of computers seems

larger. For example, consider adding the education variable. It is likely that more educated people are both more likely to use a computer and to earn higher wages and, thus, omitting the education variable in the first column causes the computer coefficient to be biased upward (see the recitation handout for the formula for omitted variable bias).

(d) Given plenty of resources, how would you design an appropriate experiment to estimate the correct value of the coefficient (i.e. the *causal* parameter) Krueger has estimated?

What Krueger is trying to estimate is the impact of computers on human productivity (assuming that higher productivity translates into higher wages). Ideally we would like to take a group of similar people (similar in age, education, race, gender and other such characteristics) who perform identical tasks (in the same industry). We could give half of them (randomly chosen) a computer and observe the productivity of those who have a computer vs. those who do not.

3. Since you have all done at least a little programming, you know it is reasonable to think of a computer as a machine that executes rules.

- Some of these rules are arithmetic rules – i.e. $6 \times 3 = 18$.
- Others are logical rules – i.e. If $[x(i) \geq 15.0]$ Go to 35.

(a) Using rules, write out as completely as you can the process of issuing an airline boarding pass to a passenger – in other words, the software that drives the kiosks for self-service check-in at most airports.

Read credit card number

Does credit card number match a credit card number in the reservation data base?

If no – send customer to see desk attendant

If yes, continue

Does credit card number have a seat already reserved?

If yes, go to 10

If no, show customer map of currently vacant seats and request customer select seat

Record selected seat

10 Ask customer how many bags he/she is checking

If none, printout boarding pass

If one or more bags are checked, call desk attendant to accept bags

Print out boarding pass and baggage claims.

(b) In footnote 6 of “The Corporation.....”, Simon writes:

“This example will seem entirely fanciful only to persons not aware of some of the research now going on into the possible automation of psychiatric processes.”

The most famous example of a computerized psychiatrist is *Eliza*, a program to mimic a Rogerian psychoanalyst written in the 1970s by Joe Weizenbaum, now an emeritus professor in Course VI.

Go to: <http://www.manifestation.com/neurotoys/eliza.php3>

and have a 10 or 15 line conversation with Eliza.

Based on your conversation describe as well as you can the structure of Eliza’s software. Then think about what you know about psychotherapy – what you have read, any first hand experience – and describe the information processing done by a human psychotherapist likely differs from the information processing in Eliza.

Presumably, Eliza’s software can parse a sentence to determine the sentences key words and whether or not it is a question.

With that information, it can formulate any of a number of responses (perhaps randomly)

A general question – Why do you want to know that?

A question that keys into your question – Why is your cat so important to you?

Etc, or, if it is having trouble, it can say - I don’t understand what you mean..

A real psychiatrist would presumably be basing each sentence on more than just your last question/statement. They would be processing your last question in the larger context of other things you had said, your body language, etc., all of which are inaccessible to Eliza.

4. Consider the following definition of skill: “The more years of training an occupation requires, the more skilled it is.” For the occupations listed below, do the following:

(a) Classify them as “high-skill” or “low-skill” based on this definition.

- (b) Write down another definition of skill (you can pick one discussed in class) and re-classify these occupations according to that definition. Does the classification change?
- (c) What is the likely impact of computers on the people involved in each occupation? Will a computer be a complement to human labor, or is it more likely to replace the people in these occupations?

Occupations (chosen from the Bureau of Labor Statistics professional specialty occupations):

- (i) Economist
- (ii) Psychologist
- (iii) Clergy
- (iv) Preschool and kindergarten teacher
- (v) Dentist
- (vi) Athlete
- (vii) Actor/entertainer
- (viii) Radio/TV announcer and newscaster

Question 4

Occupation	Yrs of training classification	Yrs of formal education classification	Requires Conscious Cognitive Effort	Computer is Substitute?	Computer is Complement?
Economist	High-Skill	High-Skill	High-Skill	No (unless we can reduce economic analysis to a few simple rules)	Yes (running regressions, managing large data sets, etc.)
Psychologist	High-Skill	High-Skill	High-Skill	No (because psychological problems are likely to be widely varying)	Not much (other than for routine tasks such as maintaining patient records)
Clergy	High-Skill	High-Skill	High-Skill	No (religion is often difficult to explain even to another human)	Could be (e.g. a priest keeping in touch via e-mail or maintaining a discussion group)
Preschool Teacher	High-Skill	Relatively Low	High-Skill	No (young children not likely to communicate well with computer and need a human to play, etc.)	Can be (if used as a learning tool)
Dentist	High-Skill	High-Skill	High-Skill	Could be (if robots can be programmed to perform dental procedures)	Yes (analyzing x-rays, simulating the results of dental procedures before we do them, etc.)
Athlete	High-Skill	Low-Skill	Low-Skill	No (who wants to watch robots play football?)	Yes (analyzing training programs, team strategies, etc.)
Actor	Low-Skill (probably)	Low-Skill	Low-Skill	Probably not (we do like to watch animation though)	Yes (movies with better special effects)
Radio/TV Announcer	High-Skill	Low-Skill	Relatively Low	Yes (computers programmed to read text)	Yes (weather forecasts, graphics, etc.)