Prolog Tutorial 1

To do this tutorial start with the trade.txt file that is provided on Cate and add clauses to it as specified below. You can use whichever text editor you like. Remember to save and *reconsult* the file after each change you make!

1. Do the Trade Program Exercises from the notes.

2. Change the fact *needs(_, computers)* to a rule that specifies every country needs computers.

3. Add that Britain, Japan, Germany, France are countries. You can do this in (at least) two different ways. Can you see how?
   In the rest of this exercise you do not need to use the concept (and predicate) *country*. So, for example if you want to query which country produces oil, for simplicity, just type the query *produces(X, oil)* rather than, for example, *country(X), produces(X, oil)*.

4. Add facts to capture the following information:
   - Britain and Japan need coal.
   - Japan needs diamonds.

5. Using a predicate *nat_res* such that *nat_res(C,I)* expresses that country *C* has item *I* as a natural resource, add facts to express the information below:

Country	Has natural resource
France	Coal
Britain	Coal
South Africa	Diamonds

6. Using a predicate *ce* such that *ce(C,I)* expresses that it is cost effective to mine item *I* in country *C*, add facts to express the information below:

Country	Can cost effectively mine
France	Coal
South Africa	Diamonds

7. Formulate and run the following queries, ensuring the answers you get are correct.

   (a) Which countries need an item which they have as a natural resource?
   Answer: britain, coal

   (b) Is there an iron producing country that can cost effectively mine an item needed by Japan?
   Answer: france, coal

   (c) Which countries need both oil and coal?

Answer: britain, japan

(d) Which countries need an item that is cost effectively mined in South Africa?
Answer: japan, diamonds

8. Using the following predicates and the ones you have already defined, add Prolog rules to express the information given in (a)–(d) below.

mines(C,I)	Country C mines item I
exports(C1,I,C2)	C1 exports item I to C2
in_competition(C1,C2,I)	C1 and C2 are in competition with respect to item I
lower_price(I)	the price of item I is lowered

(a) Any country mines its natural resources if it can do so cost effectively.

(b) Any country exports an item to another if the first country produces or mines it and the second country needs it.

(c) Any two (different) countries that export the same item are in competition with one another with respect to that item. (Use X\=Y to mean X and Y are different.)

(d) If there are two countries in competition with one another with respect to an item the price of that item will be lowered.

9. Formulate and run the following queries, ensuring the answers you get are correct.

(a) Who countries mine what?
Answer: france, coal
south_africa, diamonds

(b) Who exports at least two different items, and what are they?
Answer: france, iron, coal The answer may be repeated. That is ok.

(c) Are there any two different countries in competition with respect to oil?
Answer: oman, iraq
The answer may be repeated many times. That is ok. If you put ", !." after the last conjunct of the query, in this example, the repetitions will disappear - more on this in later lectures.

(d) Are there any two countries in competition with respect to an item they both export to Britain and Japan?
Answer: oman, iraq, oil The answer may be repeated many times. That is ok.

(e) Does Germany export anything to a country which needs something that is exported by a country which mines diamonds?
Answer: Germany exports cars to Japan that needs diamonds that are mined by South Africa.

(f) Which item needed by at least two different countries will have its price lowered?
Answer: oil !!