

Unit B1: Sets, 9/19/03

Exercise 1: North Pole

Recall our hypothetical world of North Pole and answer the following questions:

- A. Suppose that there are two reindeer. Formally define the set of reindeer labeled as R . You may call each of reindeer as you like.
- B. Continue with the assumption in A. Formally represent the fact that each reindeer is a member of the set R .
- C. Continue with the assumption in A. Using this information, formally represent the fact that two sets are identical even when the members are ordered differently.
- D. Suppose that Santa Claus does not exist. Formally define the set of Santa Claus' labeled as S .
- E. Suppose that there are no unicorns either. Formally define the set of unicorns labeled as U .
- F. Continue with the assumptions in D. and E. Discuss whether the sets S and U are identical. What kind of conclusion can you draw from this?

Exercise 2: Sentences in English

Consider the following sets and answer the questions that follow.

- S = the set of sentences
- P = the set of sentences that are in the *past* tense (e.g., "Furby slept.")
- F = the set of sentences that are in the *future* tense (e.g., "Furby will sleep.")
- Q = the set of sentences that are also *questions* (e.g., "Is Furby sleeping?")

Note: Limit the universe to only grammatically correct sentences in English.

- A. Draw a Venn diagram that would accurately represent the relation among the above sets.
- B. Give as many relationship between these sets as possible, e.g., $P \subseteq S$. But do *not* include redundant ones.

Hint: Consider all sorts of relations and operations on sets (review the slides) and find out whether you can represent them formally.

Exercise 3: Books

Consider the following sets involving a variety of books.

- B = the set of books
- F = the set of fictions
- N = the set of nonfictions
- H = the set of *Harry Potter* books
- C = the set of cook books
- T = the set of textbooks
- P = the set of picture books

- A. A book must be either a fiction or a nonfiction. That is, a book cannot be both fiction and nonfiction; but it must be one of these. Represent this fact formally.
- B. Picture books can be either fiction or nonfiction. Represent this fact formally.
- C. Suppose that there are more *Harry Potter* books than nonfiction picture books. Represent this hypothesis formally.
- D. At the *Restaurant School*, some (but not all) cookbooks are considered as a textbook. But obviously, not all textbooks are a cookbook. Represent this situation formally.
- E. We wanted to represent in our document that cookbooks are nonfictions. However, suppose that our computer happens to lack the font ' \subseteq '. How can you represent the same idea using other symbols (do not use $\{ \dots \}$)?
- F. Non-picture books include all of Harry Potter books, cook books, and textbooks. Formally represent this situation without using the symbol ' $-$ '. You may assume that our universe contains only books.
- G. Draw a Venn diagram that is consistent with all of the above conditions, including all the sets given above. If some area has some element, indicate the fact by placing ' \bullet ' (dot). If some area is completely empty, indicate the fact by placing ' \times ' (cross).
- H. Literally translate the following into English: $P - T'$

<End>