# 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 { ... })?
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>