

## Group Work, CSC-161 Introduction to Languages

Here are some definitions for you to try to decipher. Here you get to use your skills from CS14 and CS24! Read the definitions to each other, out loud, a few times! Anything confusing? Ask your teammates what they think! Remember: it's one for all and all for one. It's everyone's job to make sure every voice is heard, not matter how quiet.

**Definition 1** *An alphabet is a nonempty finite set of symbols.*

**Definition 2** *A word over an alphabet  $A$  is any string of symbols from  $A$ , including the empty word,  $\Lambda$ , the string with no symbols.*

**Definition 3** *Let  $A$  be an alphabet. The Kleene closure  $A^*$  of  $A$  is the set of all words over  $A$ .*

**Definition 4** *A language over an alphabet  $A$  is a subset of  $A^*$ .*

Each of the following sets, it turns out, is a language (as defined above) over suitably chosen alphabets:

1. the set  $L_1$  of all grammatically correct English sentences;
2. the set  $L_2$  of all valid passwords for the Hofstra portal;
3. the set  $L_3$  of all syntactically correct Python programs.

The questions that follow will ask you some questions about each of these languages (including the question "What is a suitable alphabet for this language?").

**Seven questions about each of the languages above.** Since there are three sets ( $L_1$ ,  $L_2$  and  $L_3$  above) and seven questions (on the next page), this means you have 21 questions to answer. You can either proceed set by set (so, for example, answer all seven questions about  $L_1$  first), or question by question (so, for example, answer question 1 for each of the three sets first).

After you've answered a few questions, check in with each other. Is everyone being heard? Anyone need to back up and revisit one of the questions you've answered? Anyone making any associations with other classes they've taken? Or feeling like they might be missing something from CS14 or CS24? Does your group have a mix of students who have had me as a professor before and some who haven't? Want to take time out and talk about my teaching style and how to make it work for you? Really try to find ways to loop everyone in in a way that is comfortable for them.

*Your 21 questions are on the next page!*

1. Choose an alphabet  $A_i$  such that  $L_i$  is a language over  $A_i$ .
2. Give an example of a word in  $L_i$ .
3. True or false:  $A_i \subseteq L_i$ . If false, give an example of an element of  $A_i$  that is not an element of  $L_i$ .
4. True or false:  $L_i \subseteq A_i^*$ . If false, give an example of an element of  $L_i$  that is not an element of  $A_i^*$ .
5. True or false:  $L_i = A_i^*$ . If false, give an example of a word that is in one of these sets but not both.
6. If  $u, v \in L_i$ , does it follow that the concatenation  $uv$  of  $u$  and  $v$  is also in  $L_i$ ? If not, find a pair of words  $u, v$  that comprises a counterexample.
7. True or false:  $\Lambda \in L_i$ .