1. Language Generation
   a. Open the file named language_gen.jflap
   b. Write 3 strings in the language and 3 strings not in the language
   c. Write a description of the language
   d. Open the Language Generator
      Menu: “Input” -> “Generate Language”
   e. Generate strings in the language using the text field
      • Enter a number $x$ (“3” for example) into the text field
      • Press the “# of Strings” button to generate the first $x$ strings in the language
      • Press the “String Length” button to generate all strings of length $x$
      • Experiment with different values of $x$, though it is recommended you enter less than 14 for string length and less than 50 for “# of strings” to avoid freezing.
   f. Observation:
      Take a moment to study the strings, does it match your description of the language? Try entering other lengths or # of strings. Can you come up with a better description?

2. CYK Algorithm
   a. Open the file named grammar_for_CYK.jflap
   b. Here are 6 strings in the language:
      \[
      b \hspace{1cm} abb \hspace{1cm} babbabb \\
      bbbabb \hspace{1cm} abbbbb \hspace{1cm} abbb
      \]
      Here are 3 strings NOT in the language:
      \[
      abab \hspace{1cm} aaaaabb \hspace{1cm} bbababb
      \]
   c. Open the CYK parser
      Menu: “Input” -> “CYK Parse”
   d. Parse the string babbabb using the parser
      • Enter the string into the “Input” field and press the “Set” button.
      • For the first row, fill in at least one box with all Variables that can derive the Terminal that is highlighted when that box is selected. For example, under any $a$ Terminal, you enter the only Variable that can derive it, which is $A$.
      • Select one box you haven’t filled in and press the “Do Selected” button for an example of how the box should be filled. Once you have filled in the entire first row, or pressed the “Step” button, the next row will become active to be edited. Any incorrect entries will be marked in red.
      • Select one of the boxes in the new row and press the “Animate Selected” button. Two boxes from the previous row will light up. This pair of boxes represents the RHS of a production. The leftmost box will represent the set of possibilities for the first variable and the rightmost box the second. Enter all variables that can derive some combination of the two sets. For example, if the leftmost box is the set \{A\} and the

rightmost box is the set \( \{C, S\} \), you would enter all Variables that could derive AC or AS. To enter an empty set, edit the box, but leave it empty (or press the `space` or `backspace` keys).

- Complete the remainder of the table through manually entering variables or using any of the "Step", "Do Selected", and "Complete" buttons. If you get stuck, use the "Animate Selected" button, which will now highlight multiple pairs of boxes similar to before. This follows the same logic, there are just more possibilities to consider. Each pair of boxes is considered as before, and the final entry should contain all Variables that can derive any of the pairs.
- The input string will be accepted (or rejected) when the final box is filled in. If the Start Variable is contained in that set, the string is in the language, otherwise it is not.
- You may enter any of the strings above (or string you come up with) to test them against the parser, and (if accepted) can choose "Derivation View" from the dropdown menu to view the Derivation Tree and Table.

3. Suppose you have a language over the alphabet \( \{a, b\} \), which includes all strings containing 0 or more \( a \)'s followed by an odd number of \( b \)'s.

   a. Write 3 strings in the language and 3 strings not in the language

   b. Construct a DFA for this language

   "Main Menu" -> "Finite Automaton"

In your construction, test some of the following features:

- Moving states with the state tool (hotkey s, use the right mouse key to drag and drop created states)
- Undo/Redo on features such as moving, creating, renaming, labeling, or deleting states, transitions, or notes (hotkeys ctrl-z/ctrl-y)
- Manipulating and deleting multiple objects (select by dragging or ctrl-/shift-clicking with arrow tool, delete with the "Delete" key)

If you choose to participate in the anonymous survey questions, please answer the assessment questions online at the link provided. The questions can be found on pages 3-4 and online.