Kaleb Burris
CS 331 - Programming Languages
Assignment 1

Exercise A

$$\boxed{\text{“BE SURE TO DRINK YOUR OVALTINE”}}$$

Exercise B

:)

Exercise C

1. Although the use of `let` allows for more dynamic typing, Swift primarily uses static typing.
2. This means that type checking is done in the static context - before runtime. Errors about invalid typing are thrown before the program ever executes.

Exercise D

The grammar can be also represented with the regular expression $ro*z+$

The grammar contains the strings $\boxed{1, 3, \text{and } 5}$.

Exercise E

This language contains all strings that are zero or more c's, that are optionally contained between a pair of two a's (aa) and b's (bb) where the a's are in front, and the b's are behind the zero or more c's.

Exercise F

The regular expression $x*(ab \mid c)*$ contains the strings labeled $\boxed{1, 3, 4, 5, 7}$.

Exercise G

This regular expression matches all strings that have any number of a's, b's, and c's and also have one b, by matching the arbitrary set of $[abc]$ on either side of a b.

$$\boxed{(a \mid b \mid c)*b(a \mid b \mid c)*}$$

Exercise H

1. No, this grammar contains the rule $S \to SaS$ which is not one of the accepted forms of productions for a regular grammar.
2. Yes, this grammar is context-free as all of its production's left sides are non-terminals.

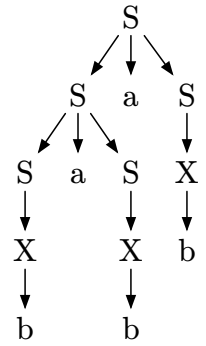
Kaleb Burris
CS 331 - Programming Languages
Assignment 1

3.
```
S
S a S
b a S
b a b
```

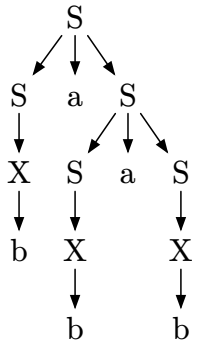
4.
```
S
S a S
S a b
b a b
```

5. The string $babab$, has two different parse trees.

Parse tree one:



Parse tree two:



6. $S \to bA$
   $A \to aS \mid \varepsilon$

Exercise E

1. $xaa+$

2.