1 Scheme

Questions

1.1 What will Scheme output? Draw the box and pointer whenever the expression evaluates to some pair or list.

\[
\begin{align*}
\texttt{> (or 'false (/ 1 0) 'true)} & \quad \rightarrow '1 2 3 \\
\texttt{> (1 2 3)} & \\
\texttt{> (cons 2 '()')} & \\
\texttt{> (cons 1 (cons 2 '()))} & \\
\texttt{> (cadar '((1 2) 3 (4 5)))} & \\
\texttt{> (caddr '((1 2) 3 (4 5)))} & \\
\texttt{> (cddar '((1 2) 3 (4 5)))} & \\
\texttt{> (cddr '((1 2) 3 (4 5)))}
\end{align*}
\]

1.2 Spot the bug(s). Test out the code and your fixes in the scheme interpreter!
(https://scheme.cs61a.org/)

\[
\begin{align*}
\text{(define (sum-every-other lst)} & \\
\text{(cond ((null? lst) lst) else (+ (cdr lst) \\
\text{ (sum-every-other (car lst)))))}
\end{align*}
\]

1.3 Define \texttt{append}, which takes in two lists and concatenates them together.

\[
\begin{align*}
\texttt{> (append '(1 2 3) '(4 5 6))} & \\
\texttt{(1 2 3 4 5 6)}
\end{align*}
\]
1.4 Define reverse. You may use append in your definition.

```scheme
> (reverse '(1 2 3))
(3 2 1)
```

1.5 Define reverse without using append. (Hint: use a helper function and cons)

1.6 Define add-to-all, which takes in an item and a list of lists, and adds that item to the front of each nested list.

```scheme
> (add-to-all 'foo '((1 2) (3 4) (5 6)))
((foo 1 2) (foo 3 4) (foo 5 6))
```

1.7 Define map, which takes in a function and a list, and applies that function to each item in the list.

```scheme
> (map (lambda (x) (+ x 1)) '(1 2 3))
(2 3 4)
```

1.8 Define add-to-all using one call to map. (Hint: consider using a lambda expression!)

1.9 Define sublists. (Hint: use add-to-all)

```scheme
> (sublists '(1 2 3))
(() (3) (2) (2 3) (1) (1 3) (1 2) (1 2 3))
```

1.10 Define sixty-ones, a function that takes in a list and returns the number of times that 1 follows 6 in the list.

```scheme
> (sixty-ones '(4 6 1 6 0 1))
1
> (sixty-ones '(1 6 1 4 6 1 6 0 1))
2
> (sixty-ones '(6 1 6 1 4 6 1 6 0 1))
3
```
1.11 Define **no-elevens**, a function that takes in a number n, and returns a list of all distinct length-n lists of 1s and 6s that do not contain two consecutive 1s.

```scheme
> (no-elevens 2)
((6 6) (6 1) (1 6))
> (no-elevens 3)
((6 6 6) (6 6 1) (6 1 6) (1 6 6) (1 6 1))
> (no-elevens 4)
((6 6 6 6) (6 6 6 1) (6 6 1 6) (6 1 6 6) (6 1 6 1) (1 6 6 6) (1 6 6 1) (1 6 1 6))
```
2 Exceptions

Questions

2.1 How do we raise exceptions in Python?

2.2 How do we handle raised exceptions? And why would we need to do so?