This worksheet is designed to allow students to work through problems similar to those that will be found on the exam. A student who feels comfortable completing these problems is well prepared for the exam.

The exam will cover the following topics:

- Differences between Lisp and other languages
- Atoms & Lists
- Expressions
- Evaluation
- List operators (list, listp, copy-list, append, cons, car cdr, nth, nthcdr, first, second, ..., last)
- Dotted lists
- Predicates (null, not, >, <, >=, <=, /=)
- If, and, or
- Format
- Progn
- Let and local variables
- Mapping functions (mapcar)
- Lambda functions
- Sequence Operators (member, length, reverse, sort)
- Arrays
- Structures
- Do
- Cond
- Function defining and parameters (&key, &rest, &optional)
- Closures

The exam covers chapters 2-7 in Graham.
1. Given the following definition of a triangle, write a function to take a list of lengths and return a list of equilateral triangles whose sides are the lengths in the list.

   (defstruct triangle a b c)

2. Write a function to produce n rows of stars where row i = 1..n has i stars:

   > (stars 5)
   *
   **
   ***
   ****
   *****
3. Write a function that takes three arguments: len, oldarray, and addit. Addit should be optional, and default to 0. The function should return a new array, containing the contents of old-array + addit, for indexes between 0 and len-1. That is: NewArray[i] = OldArray[i] + Addit, for 0 <= i < len.

4. An alternative to (defstruct rectangle length width) is to use a cons to hold the length and width.

   a. Write a function make-rectangle that takes two keyword arguments, :length and :width (which both default to 0) and creates such a cons.

   b. Write a function rectangle-width which returns the width given such a cons. Repeat for length.
5a. Write a three field structure to hold the radius, area and circumference of the circle. If given only the radius, the area and circumference should default to the correct values.

b. Write a function that given two radii, if the first is larger, the area of the corresponding circle is returned (use the structure from part a to compute the area). If the second radii is larger, the function should return the corresponding circumference. If the radii are equal, return ‘EQUAL. Use cond as appropriate.

c. Write a function that takes any number of radii as arguments, and returns the largest area. Use the function sort as appropriate.
d. Write a function that takes a circle (check it!) and a height, computes the volume of the corresponding cylinder \( V = \pi r^2 h \), the surface area \( A = 2\pi rh \), determines which is greater and prints all of this information (volume, surface area, which is greater) without computing a value twice, i.e. use local variables.

e. Write a closure which takes as input a circle and returns the largest area of a circle ever passed to it. It should return \texttt{nil} if no circles have been passed.