

1. List all the procedures in the metacircular evaluator that call `eval`.
2. List all the procedures in the metacircular evaluator that call `apply`.
3. Explain why `make-procedure` does *not* call `eval`.
4. Abelson and Sussman, exercises 4.1, 4.2, 4.4, 4.5
5. In this lab exercise you will become familiar with the Logo programming language, for which you'll be writing an interpreter in project 4.

To begin, type `logo` at the Unix shell prompt — **not** from Scheme! You should see something like this:

```
Welcome to Berkeley Logo version 5.3  
?
```

The question mark is the Logo prompt, like the `>` in Scheme. (Later, in some of the examples below, you'll see a `>` prompt from Logo, while in the middle of defining a procedure.)

5a. Type each of the following instruction lines and note the results. (A few of them will give error messages.) If you can't make sense of a result, ask for help.

```

print 2 + 3
print 2+3
print sum 2 3
print (sum 2 3 4 5)
print sum 2 3 4 5
2+3
print "yesterday"
print "julia"
print revolution
print [blue jay way]
show [eight days a week]
show first [golden slumbers]
print first bf [she loves you]
pr first first bf [yellow submarine]
to second :stuff
output first bf :stuff
end

second "something"
print second "piggies"
pr second [another girl]
pr first second [carry that weight]
pr second second [i dig a pony]

to pr2nd :thing
print first bf :thing
end

pr2nd [the 1 after 909]

print first pr2nd [hey jude]

repeat 5 [print [this boy]]

if 3 = 1+1 [print [the fool on the hill]]

print ifelse 2=1+1 ~
  [second [your mother should know]]
~
  [first "help"]

print ifelse 3=1+2 ~
  [strawberry fields forever] ~
  [penny lane]

print ifelse 4=1+2 ~
  ["flying] ~
  [[all you need is love]]

```

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```

to greet :person
say [how are you,]
end

to say :saying
print sentence :saying :person
end

greet "ringo

show map "first [paperback writer]

show map [word first ? last ?] ~
[lucy in the sky with diamonds]

to who :sent
foreach [pete roger john keith] "describe;;; The following stuff will work
end ;;;; only on an X workstation:

to describe :person
print se :person :sent
end

who [sells out]

print :bass

make "bass "paul

print :bass

print bass

to bass
output [johnny cymbal]
end

print bass

print :bass

print "bass

to countdown :num
if :num=0 [print "blastoff stop]
print :num
countdown :num-1
end

countdown 5

to downup :word
print :word
if empty? bl :word [stop]
downup bl :word
print :word
end

downup "rain

cs

repeat 4 [forward 100 rt 90]

cs

repeat 10 [repeat 5 [fd 150 rt 144] rt
36]

cs repeat 36 [repeat 4 [fd 100 rt 90]
setpc remainder pencolor+1
8
rt 10]

to tree :size
if :size < 3 [stop]
fd :size/2
lt 30 tree :size*3/4 rt 30
fd :size/3
rt 45 tree :size*2/3 lt 45
fd :size/6
bk :size
end

cs pu bk 100 pd ht tree 100

```

5b. Devise an example that demonstrates that Logo uses dynamic scope rather than lexical scope. Your example should involve the use of a variable that would have a different value if Logo used lexical scope. Test your code with Berkeley Logo.

5c. Explain the differences and similarities among the Logo operators " (double-quote), [ ] (square brackets),

and : (colon).