Eric Wan – [ezw23@drexel.edu](mailto:ezw23@drexel.edu) – Lab 9

**Question 1:**(list? L) -> (list? (reverse L))

1. Prove k=0, 1 case is true

(list? null) is true

(reverse null) outputs null, and (list? null) is still true

(list ‘(x)) is true

(reverse ‘(x)) outputs ‘(x), and (list? ‘(x)) is still true

1. Assume k=n case is true

(list? L) is assumed true

(reverse L) will output L’, and (list? L’) is assumed still true

1. Prove k=n+1 case is true

Assuming new list is ‘(x L)

(reverse ‘(x L)) will output ‘(L’ x)

‘(L’ x) => (append L’ x)

(list? L’) is true & (list? x) is true => (list? ‘(L’ x)) is true

**Question 2:**

(length (reverse x)) = (length x)

1. Prove k=0, 1 case is true

(length null) = 0

(reverse null) outputs null, and (length null) is still 0

(length ‘(x)) = 1

(reverse ‘(x)) outputs ‘(x), and (length ‘(x)) is still 1

1. Assume k=n case is true

(length L) = L is assumed true

(reverse L) outputs L’, and (length L’) is still L is assumed true

1. Prove k=n+1 case is true

Assuming new list is ‘(x L)

(length ‘(x L)) = L + 1

(length (reverse ‘(x L)) => (length ‘(L’ x)) => (+ (length L’) (length x))

(length (reverse ‘(x L)) = (+ L 1) => L + 1 = (length ‘(x L))

**Question 3:**

(reverse (append x y)) = (append (reverse y) (reverse x))

1. Prove k=0, 1 case is true

Both cases are null:

(reverse (append null null)) = (reverse null) = null

(append (reverse null) (reverse null)) = (append null null)) = null

x is null, y is ‘(y):

(reverse (append null ‘(y))) = (reverse ‘(y)) = ‘(y)

(append (reverse ‘(y)) (reverse null)) = (append ‘(y) null)) = ‘(y)

x is ‘(x), y is null:

(reverse (append ‘(x) null)) = (reverse ‘(x)) = ‘(x)

(append (reverse null) (reverse ‘(x))) = (append null ‘(x))) = ‘(x)

x is ‘(x), y is ‘(y):

(reverse (append ‘(x) ‘(y))) = (reverse ‘(y x)) = ‘(x y)

(append (reverse ‘(y)) (reverse ‘(x))) = (append ‘(y) ‘(x))) = ‘(x y)

1. Assume k=n case is true

(reverse (append X Y)) = (reverse ‘(Y X)) = ‘(X’ Y’)

(append (reverse Y) (reverse X)) = (append (Y’ X’)) = ‘(X’ Y’)

1. Prove k=n+1 case is true

(reverse (append ‘(x X) ‘(y Y)) = (reverse ‘(y Y x X)) = ‘(X’ x Y’ y)

(append (reverse ‘(y Y) (reverse ‘(x X)) = (append ‘(Y’ y) ‘(X’ x)) = ‘(X’ x Y’ y)

**Question 4:**

(reverse (reverse x)) = x

1. Prove k=0,1 case is true

(reverse (reverse null)) = (reverse null) = null

(reverse (reverse x)) = (reverse x) = x

1. Assume k=n case is true

(reverse (reverse L)) = (reverse L’) = L

1. Prove k=n+1 case is true

(reverse (reverse ‘(x L)) = (reverse ‘(L’ x)) = ‘(x L)