

CS313K: Logic, Sets, and Functions

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(Lecture 8)

Announcements

Everybody got a 10 on Tuesday's quiz.

In homeworks you can always call other functions that you've defined.

Clue to Question 98

```
(mutual-recursion
(defun vars-in-wff (x)
  (cond ((is-var x) _____)
        ((is-const x) _____)
        (t (_____
             (vars-in-wff-args (cdr x))
             _____))))))
```

```
(defun vars-in-wff-args (args)
  (if (endp args)
      _____
      (____
        (vars-in-wff (car args))
        (vars-in-wff-args (cdr args))
        _____)))
)
```

Your Questions

My Questions

(Deleted)

Example Proof

```
(defun app (x y)
  (if (consp x)
      (cons (car x)
            (app (cdr x) y))
      y))
```

Theorem:

```
(cdr (app a b))
=
(if (consp a)
    (app (cdr a) b)
    (cdr b))
```

Proof:

```
(cdr (app a b))  
=  
      ; by def of app  
(cdr (if (consp a)  
          (cons (car a)  
                (app (cdr a) b))  
          b))  
=  
      ; by cdr-if rule  
(if (consp a)  
    (cdr (cons (car a)
```

```

      (app (cdr a) b)))
(cdr b))
=
      ; by cdr-cons rule
(if (consp a)
    (app (cdr a) b)
    (cdr b))

```

q.e.d.

The way I type these proofs is that I copy the last line I wrote, write an “=” sign, paste down the copy, edit it to make the transformation I want, and then write the explanation between them. Then repeat.

So for example, when the last line was:

```
(cdr (if (consp a)
         (cons (car a)
               (app (cdr a) b))
         b))
```

The sequence was this:

```
(cdr (if (consp a)
         (cons (car a)
               (app (cdr a) b))
         b))
```

```
(cdr (if (consp a)
         (cons (car a)
               (app (cdr a) b))
         b))
```

=

```
(cdr (if (consp a)
         (cons (car a)
               (app (cdr a) b))
         b))
```

```
(cdr (if (consp a)
         (cons (car a)
               (app (cdr a) b))
         b))
```

=

```
(if (consp a)
    (cdr (cons (car a)
              (app (cdr a) b)))
    (cdr b))
```