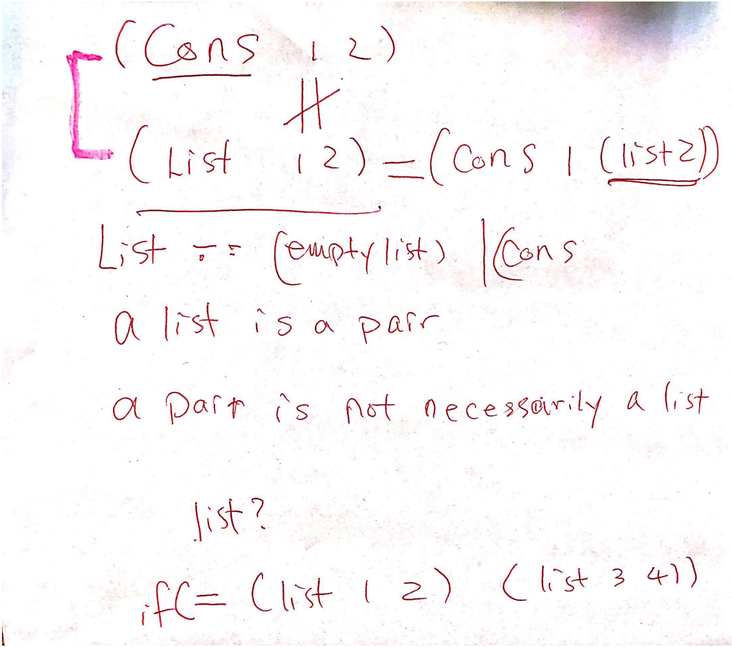
2017 Midterm Exam Lecture Notes

October 4, 2018

Pair and List



(cons 1 2)

$\neq$

(list 1 2) = (cons 1 (list 2))

List ::= (emptylist) | (cons

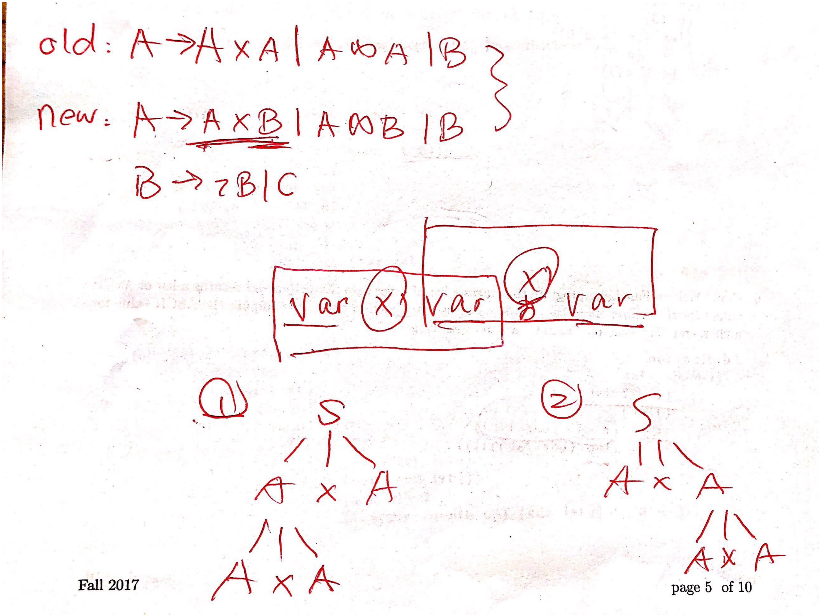
a list is a pair

a pair is not necessarily a list

list?

if (= (list 1 2) (list 3 4))

Q2



old: $A \rightarrow A \times A \mid A \infty A \mid B$

new: $A \rightarrow \underline{A \times B} \mid A \infty B \mid B$

$B \rightarrow ?B \mid C$

var x var x var
①
S
A x A
A x A
②
S
A x A
A x A

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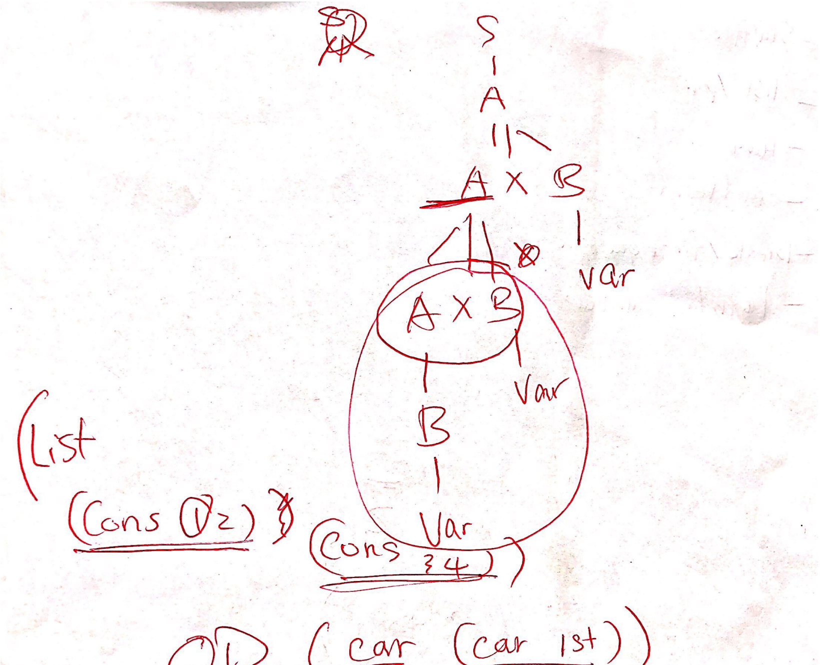
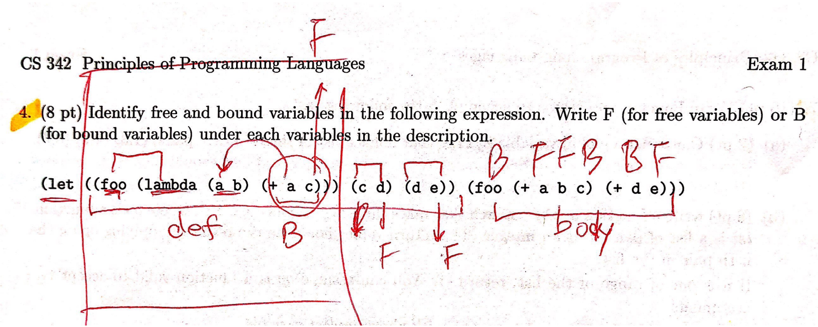
Q2



(List (Cons 1 2) (Cons 3 4))

1 (car (car lst))

Q4



CS 342 Principles of Programming Languages Exam 1

4. (8 pt) Identify free and bound variables in the following expression. Write F (for free variables) or B (for bound variables) under each variables in the description.

```
(let ((foo (lambda (a b) (+ a c))) (c d) (d e)) (foo (+ a b c) (+ d e)))
```

F

B FFB BF

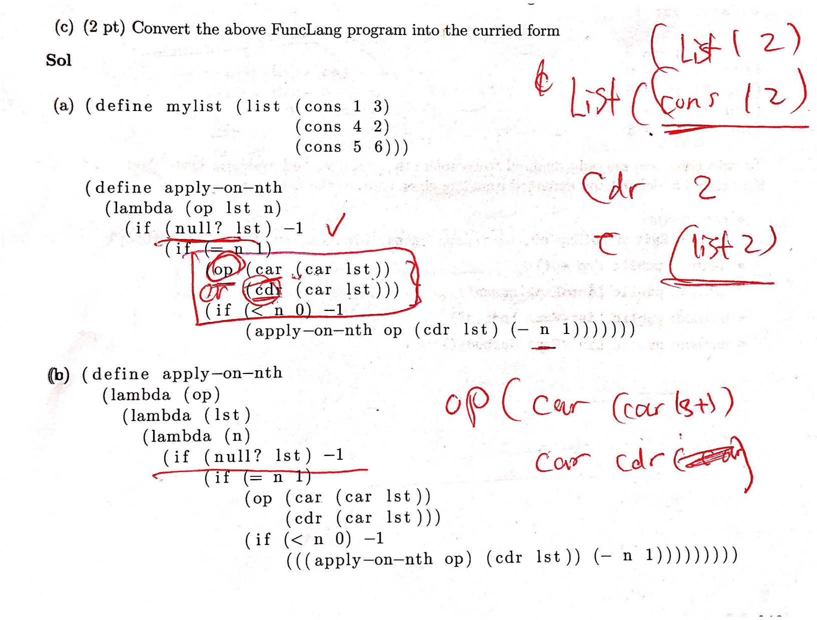
def

B

F F

body

Q7



(c) (2 pt) Convert the above FuncLang program into the curried form

Sol

```
(a) (define mylist (list (cons 1 3)
                         (cons 4 2)
                         (cons 5 6)))

    (define apply-on-nth
      (lambda (op lst n)
        (if (null? lst) -1  ✓
          (if (= n 1)
            (op (car (car lst))
             or (cdr (car lst)))
            (if (< n 0) -1
              (apply-on-nth op (cdr lst) (- n 1)))))))
```

```
(b) (define apply-on-nth
      (lambda (op)
        (lambda (lst)
          (lambda (n)
            (if (null? lst) -1
              (if (= n 1)
                (op (car (car lst))
                    (cdr (car lst)))
                (if (< n 0) -1
                  (((apply-on-nth op) (cdr lst)) (- n 1)))))))))
```

(List 1 2)

¢ List (cons 1 2)

Cdr 2

c (list 2)

op (car (car lst))

car cdr (