Informatics 41 • Fall 2004 • David G. Kay • UC Irvine Your name _____

NINTH QUIZ

Your student ID _____

You have 15 minutes from the start of class to complete this quiz. Read the questions with care; work with deliberate speed. Don't give us more than we ask for. The usual instructions apply. Good luck!

Problem 1 (12 points)

On last week's quiz we had definitions very similar to these:

```
;; vector-sum: vector-of-numbers -> number
(define vector-sum
  (lambda (v)
    (vector-sum-aux v 0 (sub1 (vector-length v)))))

(define vector-sum-aux
  (lambda (v start end)
    (cond
      ((> start end) 0)
      (else (+ (vector-ref v start)
               (vector-sum-aux v (add1 start) end))))))
```

Complete the definitions below to create an accumulator-style version:

```
;; vector-sum2: vector-of-numbers -> number
(define vector-sum2
  (lambda (v)
    (vector-sum-aux-accum v 0 (sub1 (vector-length v)) _____________)))

(define vector-sum-aux-accum
  (lambda (v start end sum-so-far)
    (cond
      ((> start end) _____________)
      (else (vector-sum-aux-accum v (add1 start) end

                  (_____________   _____________

                                   (_____________ v _____________)))))))
```

Problem 2 (4 points)

There are four functions defined above.

– Write "R" next to each of the functions that is recursive.

– Write "T" next to each of the functions that is tail recursive.

Some functions may be both "R" and "T"; some may be neither. Consider each function alone, independently of the others (i.e., pay no attention to the other functions that a given function calls).

Problem 3 (3 points)

In one brief English sentence, why do we care about tail recursion? In other words, what's better about a tail-recursive function than a function that produces the same results non-tail-recursively?

Problem 4 (6 points)

For each of the questions below, circle the one most complete, most correct answer (A, B, C, D, or E).

(a) Your new wristwatch includes a black-and-white digital camera that uses four bits for each pixel. How many different shades of gray can each pixel represent?

A. 8
B. 16
C. 24
D. 32
E. 4

(b) Why do computers use binary circuitry?

A. Binary numbers are easier for people to understand than decimal numbers.

B. It is impossible to represent decimal values directly in electronic circuitry.

C. Binary circuitry is much cheaper, faster, and more reliable than components that deal directly with more than two values.

D. Input and output of decimal numbers is highly inconvenient.

E. Computers are very hip machines, deeply into Yin and Yang and the cosmic duality of the universe.

(c) Which of the following could possibly be the ASCII representation of the word "DOG"? (You do not need to know the actual ASCII codes to answer this question correctly.)

A. `0100 0000 0111`

B. `0100 0100 0100 1111 0100 0111`

C. `000 100 000 110 000 011`

D. `0100 0100 0100 1100 0100 0111 0100 1001`

E. `0100 0100 0100 0100 0100 0100`