Informatics 41 • Fall 2005 • David G. Kay • UC Irvine Your name _____

EIGHTH 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 (5 points)

For each of the algorithms or operations described below, check the box corresponding most closely to its complexity (i.e., its O-notation).

(a) `(cons 'turkey L)` where `L` is a list of n symbols.
❏ Constant—O(1) ❏ Logarithmic—O(log n) ❏ Linear—O(n) ❏ Quadratic—O(n^2)

(b) `(foldr + 0 (map f L))` where `f` is a function and `L` is a list of n items.
❏ Constant—O(1) ❏ Logarithmic—O(log n) ❏ Linear—O(n) ❏ Quadratic—O(n^2)

(c) .In a binary search tree of n restaurants, ordered by name, find a restaurant given its name.
❏ Constant—O(1) ❏ Logarithmic—O(log n) ❏ Linear—O(n) ❏ Quadratic—O(n^2)

(d) Adding the 45th and the 729th elements of an n-element vector (where $n \geq 729$).
❏ Constant—O(1) ❏ Logarithmic—O(log n) ❏ Linear—O(n) ❏ Quadratic—O(n^2)

(e) From a binary search tree of n restaurants, ordered by name, print an alphabetical list of all the restaurants.
❏ Constant—O(1) ❏ Logarithmic—O(log n) ❏ Linear—O(n) ❏ Quadratic—O(n^2)

Problem 2 (2 points)

List two characteristics of binary circuitry that makes it especially effective for storage in modern computers (as opposed to using a component that directly represents more than two different values).

Problem 3 (3 points)

Choose one or the other:

— List three kinds of computational resources that an operating system helps manage

— List three categories of functionality that a modern operating system performs

Problem 4 (1 point)

How many bits does it take to represent 8 different values?

Problem 5 (11 points)

Suppose you have a vector of rrant structures, which are defined as usual:

```
(define-struct rrant (name cuisine phone dish price))
```

(a) (3 points) Complete the following definition:

```
;; Nth-rrant:  vector-of-rrant  number  ->  rrant
;; Return the rrant at the specified position in the vector (zero-based)
(define Nth-rrant
    (lambda (RV N)
        (cond
            ((or (< N 0) (>= N (vector-length RV))) (error N "Vector ref out of range"))
            (else
```

(b) (3 points) Suppose you have the function `vector-map`, which takes a vector and a function and returns a new vector whose contents are the results of applying the function to each element of the input vector. Thus, `(vector-map (vector 3 4 5) double)` would return `(vector 6 8 10)`.

Complete the following definition that changes all the prices in a vector of rrant structures:

```
;; adjust-prices-in-vector:  vector-of-rrant number -> vector-of-rrant
;; Adjust each price in the input vector by the specified percentage
(define adjust-prices-in-vector
    (lambda (RV adjustment-percentage)
        (local ((;; adjust-one-price:  number -> number
                 ;; Increase price by a pre-specified percentage
                 define adjust-one-price
                   (lambda (n)
                     (/ (* n (+ 100 adjustment-percentage)) 100))))
    (vector-map
        _______________

        (lambda (R) (_______________ (rrant-name R) (rrant-cuisine R)
                                    (rrant-phone R) (rrant-dish R)

                                    (_______________ (_______________ _______________)))))))
```

(c) (5 points) Complete the definition of vector-map below.

```
;; vector-map:  vector-of-X (X -> Y) -> vector-of-Y
;; Applies the function to each element of the vector of Xs, returning a new vector of Ys.
(define vector-map
    (lambda (v f)
        (build-vector
```