

# CS2500 Exam 1 – Spring 2012

Name: \_\_\_\_\_

Student Id (last 4 digits): \_\_\_\_\_

Instructor's Name: \_\_\_\_\_

- Write down the answers in the space provided.

- You may use the usual primitives and expression forms, including those suggested in hints; for everything else, define it.

- The phrase “design this function/program” means that you should apply the design recipe. You are *not* required to provide a template unless the problem specifically asks for one. Be prepared, however, to struggle with the development of function bodies if you choose to skip the template step.

• You may write  $c \rightarrow e$  in place of (check-expect  $c e$ ) to save time writing.

<b>Problem</b>	Points	out of
1		5
2		5
3		10
4		10
<b>Total</b>		30

*Good luck!*



**Problem 1.** Your new startup, WellnessTech, produces smart-phone applications that help people monitor and improve their health.

As part of your current product offering, you are implementing code that monitors the user's heart rate during exercise. When you exercise, you should try to keep your heart rate at approximately 75% of your maximum heart rate; in turn, your maximum heart rate is computed as 220 minus your age.

Design a function, `target-heart-rate` that consumes the user's age and produces his suggested target heart rate during exercise.

[Here is more space for you to write your answers.]

**Problem 2.** Write the step-by-step computation that would be taken if you ran this program in the Stepper. For each step, label it as either:

- **arith:** Primitive “arithmetic” (of any form, not just numeric operations)
- **plug:** Function application—“plugging in”
- **conditional:** A conditional step.

```
;;; my-max : Number Number -> Number
;;; Return the larger of the two
;;; numbers.
```

```
(define (my-max a b)
  (cond [(< a b) b]
        [else a]))
```

```
(my-max (* 3 4) 7)
```



**Problem 3.** You are designing a system to do automated trading on Wall Street, using the following data definition:

```
(define-struct stock (company num-shares share-price))

;;; A Holding is one of:
;;; -(make-stock String Number Number)
;;; -Number
;;; where a simple number means cash, in US dollars,
;;; and a stock structure represents a block of shares
;;; in some company.
```

a. What kind of data definition is a `Holding`?

b. Write the template for a function that consumes a `Holding` and produces a `Number`.

[Here is more space for you to write your answers.]



**Problem 4.** Write a function called `extract-positives` which satisfies the following contract and purpose:

```
;; extract-positives : list-of-number -> list-of-number
;; consumes a list of numbers and produces a list of all
;; the positive numbers from the list
;; (consider 0 positive)
```

[Here is more space for you to write your answers.]