Exam #1

CMPS 359, Fall 2019

Name/ULID: ....

Note: This exam contains 6 pages. Please make sure that you have that number of pages (plus one more page of notes). The overall points are 100 plus 5 bonus points.

1. Expression evaluations _____ 3*10=30 points

For each of the following expressions, (1) intuitively describe what it does and (2) give the evaluation result. For a sequence of expressions across multiple lines, the result you should write is the result of evaluating the final expression.

(a) `(string-length (string-append "foo" "bar"))`

(b)
```
(define (my-func x) (+ (sqr x) 2))
(my-func 2)
```

(c) `(/ 2 5)`

(d)
```
(struct point [x y])
(point-x (point 1 2))
```

(e) `(substring "hello" 0 3)`

(f) `(string-ref "hello" 1)`

(g)
```
(define x 1)
(define y 2)
(cond
  [(= x 2) x]
  [(> y 1) y])
```

(h) `(rectangle 10 10 "black" "outline")` draw the result

(i) `(if (< 1 2) "true" "false")`

(j) `(image-height (rectangle 10 15 "black" "outline"))`

2. Design Process _____ 5*4=20 points

Consider the following function definition corresponding to: $||(x, y, z)|| = \sqrt{x^2 + y^2 + z^2}$:

```
(1)  (struct r3 [x y z])
(2)  ;; An R3 is a structure
(3)  ;; (r3 Number Number Number)
(4)  ;; Interpretation a point in 3D real valued space
(5)  (define ex1 (r3 1 0 0))
(6)  (define ex2 (r3 0 2 0))

(7)  ;; R3 -> Number
(8)  ;; Calculate the distance to the origin of a point in R3
(9)  (define (distance pt)
(10)    (sqrt (+ (sqr (r3-x pt)) (sqr (r3-y pt)) (sqr (r3-z pt)))))
(11) (check-expect (distance ex1) 1)
(12) (check-expect (distance ex2) 2)
(13) (test)
```

For each step of the design process listed below via (1) through (6), list the lines that correspond to that step of the design process. If no lines correspond, write NA.

(1)

(2)

(3)

(4)

(5)

(6)

3. Carrying out Design Steps _____10+5+5+10=30 points

1. Look at the following function definition that converts Celsius temperatures to Fahrenheit temperatures. On line 1 give a data interpretation for Celsius temperatures. On line 2 provide an interpretation for Fahrenheit. On line 3 give a signature for the function. On line 4 give a statement of purpose. On line 7, turn the functional example on line 5 into a test.

```
(1)
(2)
(3)
(4)
(5) Given: 0 Expect: 32
(6) (define (C-to-F c) (+ (* 9/5 c) 32))
(7)
```

2. Let us say that we then add the following test on line (8): `(check-expect (C-to-F 5) 41)`. Does this test succeed or fail? If it fails, explain why it fails and indicate whether the test or the function definition is incorrect.

3. Let us say that we then add the following test on line (9): `(check-expect (C-to-F 10) 59)`. Does this test succeed or fail? If it fails, explain why it fails and indicate whether the test or the function definition is incorrect.

4. Let us say we are tasked with designing a function and have finished steps 1-3 in our design process. The function takes in a key-event and returns 1 when the key that was pressed was the space bar (" "). Otherwise it returns 0. Write a skeleton for the following code after line (5) of the top definiton. Then complete step 5 on the bottom definition and turn the skeleton into final code.

```
(1) ;; KeyEvent -> Boolean
(2) ;; If the spacebar was pressed return 1 else return 0
(3) ;; Given: " " Expect: 1
(4) ;; Given: "f" Expect: 0
(5) (define (space-press? ke)
```

```
(1) ;; KeyEvent -> Boolean
(2) ;; If the spacebar was pressed return 1 else return 0
(3) ;; Given: " " Expect: 1
(4) ;; Given: "f" Expect: 0
(5) (define (space-press? ke)
```

4. Defining functions _____10+10=20 points

In these questions, you won't have to worry about the design process. Just write the code to complete the function definition. Assume you have the following defined: `(struct editor [pre post])`, where the fields pre and post will contain strings.

1. Finish the following function which appends a key to the string in the pre of some editor struct parameter (ed) and returns some new editor struct instancecontaining this new string in pre and the editor parameter's post string in post. Assume this function only takes in keys that can be displayed nicely like "a", "!", etc. You are given:

```
;; Editor String -> Editor
;; Given: (editor "hello" "world") " " Expect: (editor "hello " "world")
(define (add-key ed ke)
```

2. Finish the following function which creates a new string that "deletes" the first character from the string in the post string of some editor parameter. This new string goes into the post field of some new editor that is returned. This new editor's pre string is the same as the editor parameter's pre string.

```
;; Editor -> Editor
;; Given: (editor "hello" "world") Expect: (editor "hello" "orld")
(define (delete-key ed)
```

5. Bonus _____ 3+2=5points

There are two bonus point questions.

1. What is a piece of art (painting, movie, album, etc.) that you love? Why?

2. What do you want to do as a computer scientist? Or, if you don't plan on becoming a computer scientist, what do you want out of taking computer science courses?