BBM 301 - Programming Languages - Fall 2021 2nd Midterm
December 10, 2021

Name: ____

Student ID number: ________________________

Please write your name, ID and following honor pledge:
"**On my honor, I pledge that I have neither given nor received any unauthorized assistance on this exam.** "

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and **sign** your answer sheet.

1- [10pts] Scheme

You are given the following Scheme definitions

```
(define lis1 '(a b c))
(define lis2 '(1 (2) 4))
(define lis3 '(2 3 5))
```

The following code segments are written to produce the corresponding outputs. However, there are slight mistakes and they don't produce the desired outputs. Correct the code segments to produce the desired outputs. In your answer sheet, write only the correct code segment for each part.

	Code Segment	Desired Output
a)	`(map (lambda (x) (* 2 x)) (car lis3))`	`(9 15)`
b)	`(append (car lis1) lis2)`	`(a 1 (2) 4)`

c)	`(let ((a 1) (b 5))`
	` (let ((a 10)`
	`       (c (- a b)))`
	`   (* c a)))`
		`50`

2- [15 pts] Scheme

This question is about writing an extension of the `map` function in Scheme, called funcQ2. Basically, this new function takes three parameters: where the first parameter is a list of operations or functions, and the other parameters are lists of numbers. funcQ2 iterates over the list of given functions and apply each function to each of the corresponding elements of the lists. Here are some example input and outputs of the function.

```
>(funcQ2 '(> < -) '(1 2 3 4) '(2 3 4 5))

=>  ((#f #f #f #f) (#t #t #t #t) (-1 -1 -1 -1))

>(funcQ2 '(+ - * /) '(3 4) '(1 5))

=> ((4 9) (2 -1) (3 20) (3 0.8))

>(funcQ2 '(max min) '(2 10 5 1) '(4 4 4 8))

=> ((4 10 5 8) (2 4 4 1))

>(funcQ2 '() '(3 4) '(1 5))

=> ()
```

A partly filled Scheme function for funcQ2 is given below:

```
(define (funcQ2 oplist list1 list2)
      (cond
            ((null? oplist) ____________)
            ((null? list1) _____________)
            (___________________________)
      (else
      (cons   (____________________________________________  list1  list2)
      (__________________________________________))
))
)
```

In your answer sheet, please write the full version of this function.

3- [20 pts] Scheme

a) Write a Scheme function called funcQ3 that is **not in tail-recursive form**, to construct a list <a_n> such that **$a_n = a^2_{n-1} + 3$**, where **a_0=5**. The length of the list should also be a parameter. The example input and outputs of this function should be as follows:

```
>(funcQ3 1)
=> (5)

>(funcQ3 2)
=> (5 28)
>(funcQ3 4)
=> (5 28 628 394387)
```

a) Write the same function described above in **tail recursive** form.