

CMPE 100 – Mid-term Exam – 2013-2014 Fall

Student Name: _____ Student Number: _____

PART A: (TOTAL 21 points) Answer the following questions by giving the value and data type resulting from the given expression. Some examples are given in the first two lines:

		VALUE	DATA TYPE
	<code>(square 100 "solid" "black")</code>	A square of size 100	Image
	<code>(+ 3 5)</code>	8	number
1	<code>(/ (+ 7 5) (* 2 2))</code>		
2	<code>(or (< 4 3) (> 3 2))</code>		
3	<code>(cond (> 3 2) "a" (< 3 5) "b" (else "n"))</code>		
4	<code>(scale 2 (square 100 "solid" "black"))</code>		
5	<code>(image-height (circle 100 "solid" "black"))</code>		
6	<code>(cond (< 2 1) 1 (< 2 3) (< 2 3) (else "a"))</code>		
7	<code>(cond ((and false (< 2 3)) 3) (cond (< 2 3) 4 (else 5)))</code>		

PART B: (TOTAL 24 points) Examine each of the short programs below. For each, find the mistakes in the following program, or if there are no mistakes indicate that. Some examples are given in the first two lines:

		Indicate if correct, or describe the mistake(s)
	<pre>(define (f x) (+ x y))</pre>	y is not defined anywhere in the program
	<pre>(define (f x) (* x x))</pre>	No mistakes
1	<pre>(define (f x y z) (cond ((and (<= x z) (+ x y)) x) (else y)))</pre>	
2	<pre>(define (f x n) (cond ((= n 0) 1) (else (f (- n 1))))))</pre>	
3	<pre>(define (f x) x)</pre>	
4	<pre>(define (f n) (* 2 (f (- n 1))))</pre>	
5	<pre>(define (f x y) (cond ((> y x) y) ((> x y) x)))</pre>	
6	<pre>(define (f x n) (cond ((= n 0) 1) (* x (f x (- n 1))))))</pre>	

PART C: (TOTAL 50 points in 5 problems) In each of the questions below write the function to produce the described output according to problem statement. Make sure to include cases in which program must produce an error. Also put test cases (i.e. `check-expect` tests) in your programs. You need to add documentation comments only if you find them necessary to describe your approach.

Write your programs in the space given below each question, not on a separate answer sheet!

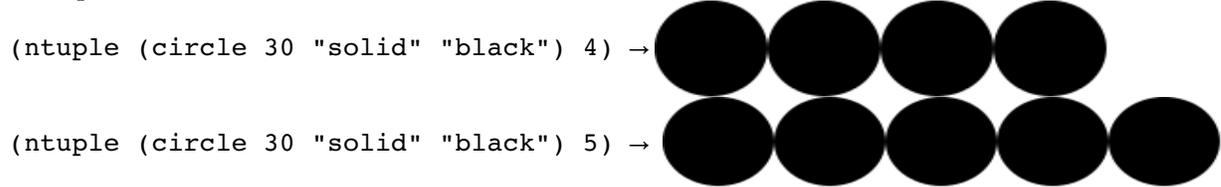
1. **(6 points)** Write a function named `'cube'` which takes a number as a parameter and returns its cube (i.e. its 3rd power). For example:
`(cube 3) → returns 27`

2. **(6 points)** Write a function named `'triple'` which takes an image as a parameter, and returns an image which contains three copies of the given image side by side. For example:

`(triple (circle 30 "solid" "black")) →`



3. **(11 points)** Write a function named 'ntuple' which takes an image and a positive integer, n , as parameters, and returns an image which contains n copies of the given image side by side. For example:



4. **(11 points)** A function, f , is defined as follows:

$$f(n) = \begin{cases} 1 & \text{if } n \leq 1 \\ n + f(n-1) & \text{otherwise} \end{cases}$$

Write a program which implements this function. For example:

(f 3) → returns 6

5. **(16 points)** Euler's number is used widely in mathematics. It is computed using the following infinite series:

$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \frac{1}{0!} + \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + \frac{1}{4!} + \dots$$

Naturally, one must truncate the infinite series sum at some point to finish computation. Write a function named `finde` to compute the series sum up to k^{th} term (you may omit test cases in this problem). For example:

`(finde 10) → returns 2.718281525573192239858906`