
# CS 315
# Homework 3

## Recursive Functions in Scheme

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Section 1

1. **Chosen mathematical function:** f(k) = $(k + 1)^2$

- **cankara_zeynep.scm:**

```
;;; f,  f(k) =(k+1)^2
(define (f k)
      (+ (+ (* 2 k)(* k k)) 1))
```

- **trace calls:**

```
(trace f)
(f 0)
(trace f)
(f 1)
(trace f)
(f 10)
```

- **Output:**

```
|(f 0)
|1
|(f 1)
|4
|(f 10)
|121
```

2. **Recursive sum-of-f(k):** sum-of-f(k) = f(k) + sum-of-f(k-1)

- **cankara_zeynep.scm:**

```
;;; sum-of-f:  sum-of-f(k) = f(k) + sum-of-f(k-1)
(define (sum-of-f k)
  (if (< k 1) (f k) (+ (f k)
                  (sum-of-f (- k 1)) )))
```

- **trace calls:**

```
(trace sum-of-f)
(sum-of-f 0)
(trace sum-of-f)
```

```
(sum-of-f 1)
(trace sum-of-f)
(sum-of-f 10)
```

- **Output:**

```
|(sum-of-f 0)
|1
|(sum-of-f 1)
| (sum-of-f 0)
| 1
|5
|(sum-of-f 10)
| (sum-of-f 9)
| |(sum-of-f 8)
| | (sum-of-f 7)
| | |(sum-of-f 6)
| | | (sum-of-f 5)
| | | |(sum-of-f 4)
| | | | (sum-of-f 3)
| | | | |(sum-of-f 2)
| | | | | (sum-of-f 1)
| | | |[10](sum-of-f 0)
| | | |[10]1
| | | | | 5
| | | | |14
| | | | 30
| | | |55
| | | 91
| | |140
| | 204
| |285
| 385
|506
```

3. **Tail recursive sum-of-f(k):** sum-of-f-tr

- **cankara_zeynep.scm:**

```
;;; sum-of-f-helper, helper function of tail recursive function f
(define (sum-of-f-helper k partial)
                      (if (< k 1)
                         partial
                         (sum-of-f-helper (- k 1) (+ (f k)
partial) ) ) )

;;; sum-of-f-tr, tail recursive version of sum-of-f
(define (sum-of-f-tr k)
                   (sum-of-f-helper k (f 0)))
```

- **trace calls:**

```
(trace sum-of-f-tr)
(sum-of-f-tr 0)
(trace sum-of-f-tr)
(sum-of-f-tr 1)
(trace sum-of-f-tr)
(sum-of-f-tr 10)
```

- **Output:**

```
|(sum-of-f-tr 0)
|1
|(sum-of-f-tr 1)
|5
|(sum-of-f-tr 10)
|506
```