Project: A Combinatorial Calculator

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Module Title: Foundation of Computer Science

Problem Statement/Application

Calculating Permutations and Combinations

Permutations (n)

$$n! \qquad n \geq 0$$

r_Permutations (n, r)

$$\frac{n!}{(n-r)!} \qquad n \geq 0 \quad n \geq r$$

r_Combinations

$$\frac{n!}{(n-r)! * r!} \qquad n \geq 0 \quad n \geq r \quad r \geq 0$$

Working with Long Lists

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Main Function

- What does the function do:

1. Takes sample data
2. Filters out malformed data
   (depending on the conditions)
3. Outputs correct data
   (depending on the function used)

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Main Function

- Input data:

1 list of elements (n)

2 lists of subsets containing 2 elements each (n, r)

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Main Function

- Conditional and recursion:

```
; Function to get #t from a non-negative number

(define non-negative?
  (lambda (n)
    (not (negative? n))))


; Function to filter out sublists, where n < 0

(define (filter-non-negative-n lst)
  (filter
   (lambda (sublist)
     (non-negative? (car sublist))) lst))

; Function to filter out sublists, where n < 0 && r < 0

(define (filter-non-negative-n-r lst)
  (filter
   (lambda (sublist)
     (andmap non-negative? sublist)) lst))

; Function to filter out sublists, where n < r

(define (filter-n-greater-or-equal-to-r lst)
  (filter
   (lambda (sublist)
     (apply >= sublist)) lst))
```

```
; Function to get the factorial of n (n!)

(define factorial (lambda (n)
                    (if (= n 0)
                        1
                        (* n (factorial (- n 1))))))
```


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Main Function

- A function call with test cases

```
(display "r_Combinations list: ")
(displayln (map calculate-r-combinations r_combinations_list))
(display "\n")
```

```
Original list: ((-1 1) (1 -1) (3 5) (0 0) (1 0) (5 3) (5 4) (5 5) (7 3))
Filtered list: ((0 0) (1 0) (5 3) (5 4) (5 5) (7 3))
r_Combinations list: (1 1 10 5 1 35)
```


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Using ChatGPT

- Brainstorming
- Math validiation
- Code fixing or simplification

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Thank you

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