National University of Singapore
School of Computing
SWS3012: SICP
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R8B
Mutable Data

Problems:

1. Consider the following function declaration:

    ```
    function change(x, new_value) {
        x = new_value;
    }
    ```

    Consider the following statements:

    ```
    let x = 0;
    change(x, 1);
    ```

    What is the value of x after the above statements are evaluated? Why? Explain your answer using the environment model.

2. Write the function `d_filter` that takes as arguments a one-argument predicate function `pred` and a list `xs`, and returns a list that contains only those elements for which `pred` returns `true`. Your function must not create any new pair, and the result list must only be made of existing pairs in `xs`. Your function must not modify the head of any of the existing pairs.

    ```
    function d_filter(pred, xs) {
        // ???
    }
    ```

    Example call:

    ```
    const L = list(1, 2, 3, 4, 5, 6, 7, 8, 9, 11);
    d_filter(x => x % 2 === 0, L);  // returns [2, [4, [6, [8, null]]]]
    L;  // What is L now?
    ```

3. Given the following Source program:

```
let a = 10;

function foo(x) {
    let b = 0;

    function goo(x) {
        let a = 30;

        if (x <= 2) {
            a = a + x;
            b = b + x;
            // Breakpoint #4
        } else {
            // Breakpoint #3
            goo(x - 1);
        }
    }

    a = a + x;
    b = b + x;
    // Breakpoint #2
    goo(3);
}

// Breakpoint #1
foo(1);
// Breakpoint #5
```

Evaluate the program and draw all the frames of the environment that have been created up to each breakpoint. Also indicate the **current environment** in the environment diagram at each breakpoint.