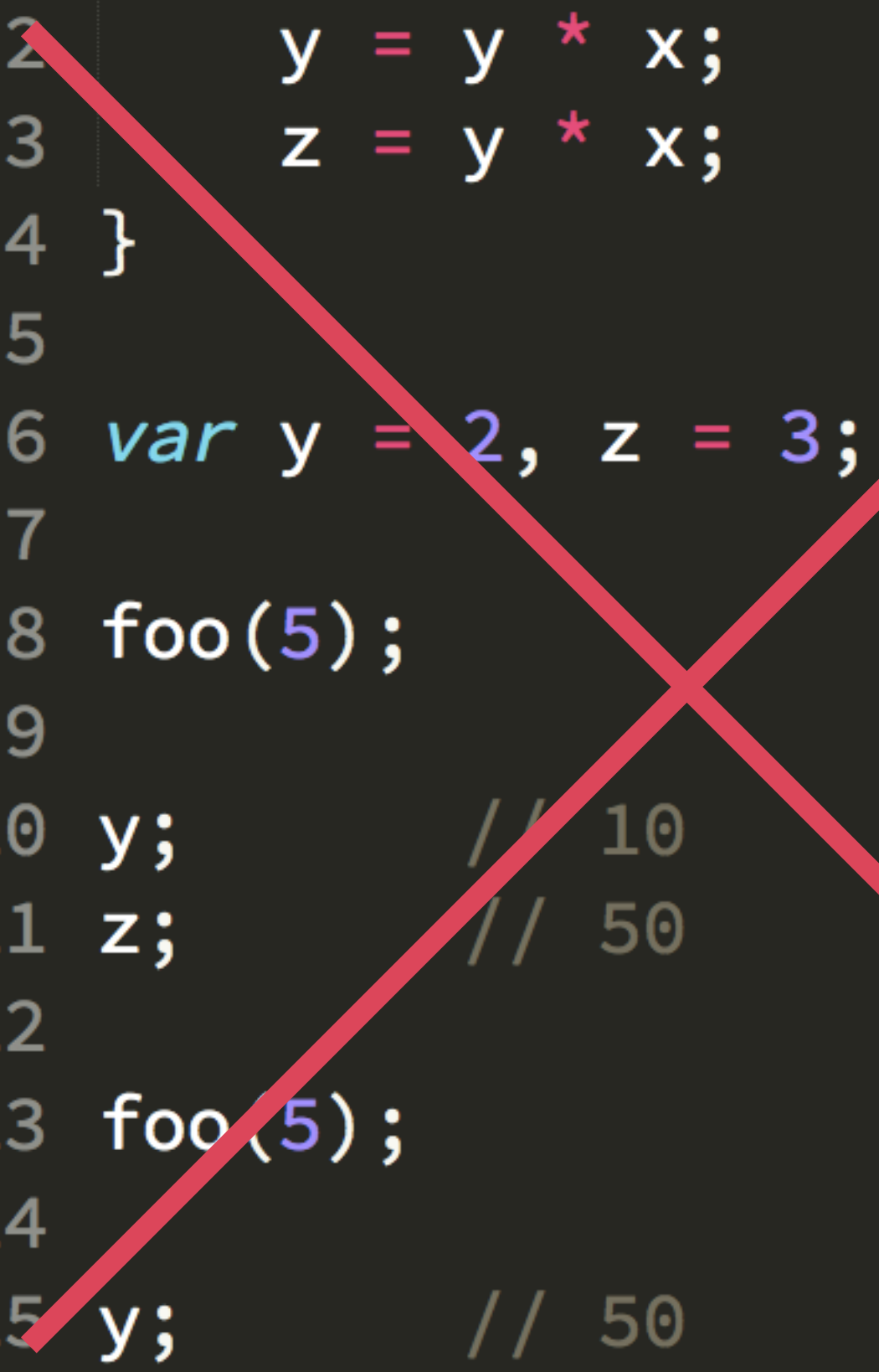


KYLE SIMPSON @GETIFY

FUNCTIONAL-LIGHT JAVASCRIPT

~~SIDE EFFECTS~~

```
1  function foo(x) {  
2      y = y * x;  
3      z = y * x;  
4  }  
5  
6  var y = 2, z = 3;  
7  
8  foo(5);  
9  
10 y;           // 10  
11 z;           // 50  
12  
13 foo(5);  
14  
15 y;           // 50  
16 z;           // 250
```



PURE FUNCTIONS

```
1  function bar(x,y,z) {
2      foo(x);
3      return [y,z];
4
5      // *****
6
7      function foo(x) {
8          y = y * x;
9          z = y * x;
10     }
11 }
12
13 bar(5,2,3);           // [10,50]
14 bar(5,10,50);        // [50,250]
```

COMPOSITION

```
1 function sum(x,y) {  
2     return x + y;  
3 }  
4  
5 function mult(x,y) {  
6     return x * y;  
7 }  
8  
9 // 5 + (3 * 4)  
10 var x_y = mult( 3, 4 );  
11 sum( x_y, 5 );           // 17
```

```
1 function sum(x,y) {  
2     return x + y;  
3 }  
4  
5 function mult(x,y) {  
6     return x * y;  
7 }  
8  
9 // 5 + (3 * 4)  
10 sum( mult( 3, 4), 5 ); // 17
```



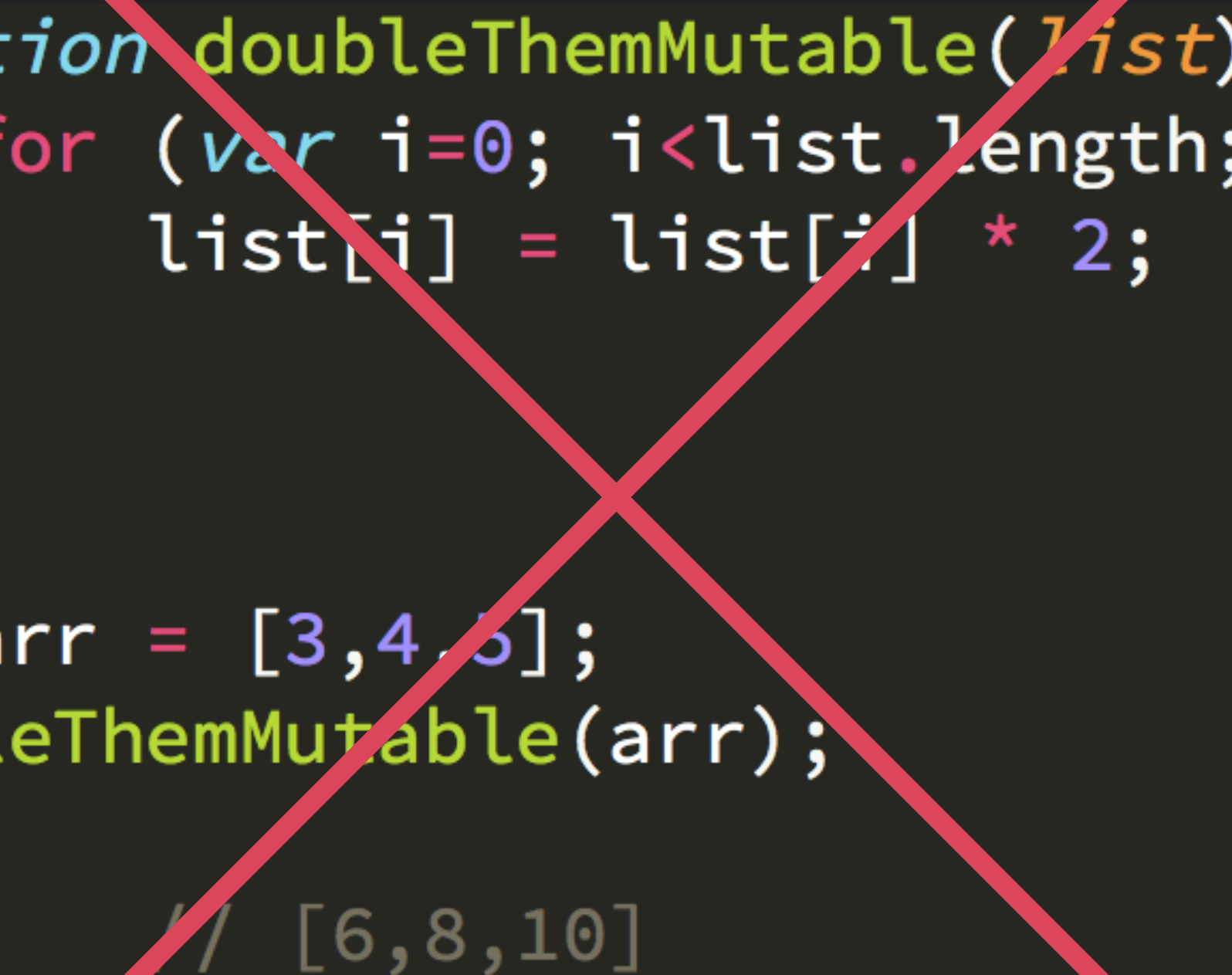
```
1  function sum(x,y) {
2      return x + y;
3  }
4
5  function mult(x,y) {
6      return x * y;
7  }
8
9  function multAndSum(x,y,z) {
10     return sum( mult( x, y ), z );
11 }
12
13 // 5 + (3 * 4)
14 multAndSum(3,4,5);           // 17
```

```
1  function sum(x,y) {
2      return x + y;
3  }
4
5  function mult(x,y) {
6      return x * y;
7  }
8
9  function compose2(fn1,fn2) {
10     return function comp(arg1,arg2,arg3){
11         return fn2(
12             fn1( arg1, arg2 ),
13             arg3
14         );
15     };
16 }
17
18 var multAndSum = compose2(mult,sum);
19
20 // 5 + (3 * 4)
21 multAndSum(3,4,5);           // 17
```

IMMUTABILITY

```
1  var x = 2;
2  x++; // allowed
3
4  const y = 3;
5  y++; // not allowed
6
7  const z = [4,5,6];
8  z = 10; // not allowed
9  z[0] = 10; // allowed!
```

```
1 var z = Object.freeze([4,5,6,[7,8,9]]);  
2  
3 z[0] = 10;           // not allowed  
4 z[3][0] = 10;        // allowed!
```



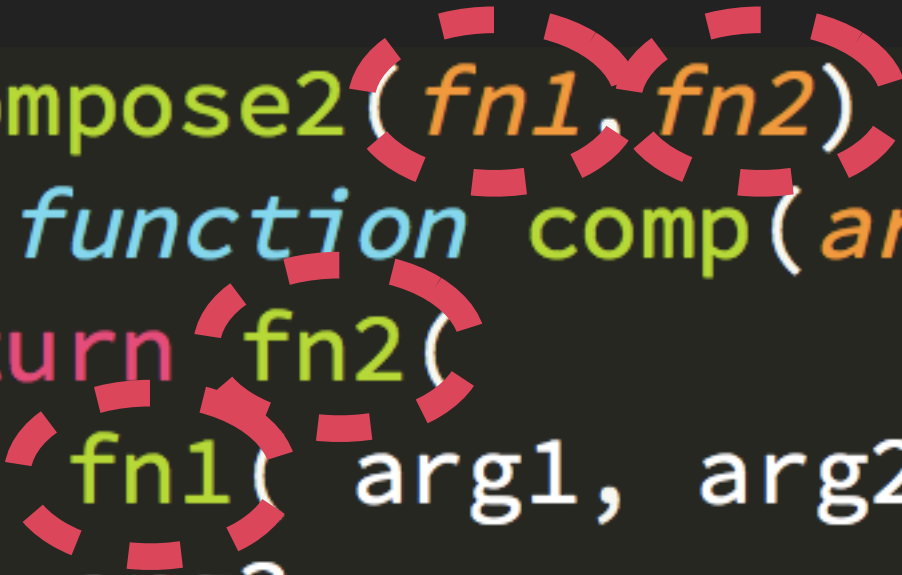
```
1 function doubleThemMutable(list) {  
2     for (var i=0; i<list.length; i++) {  
3         list[i] = list[i] * 2;  
4     }  
5 }  
6  
7 var arr = [3,4,5];  
8 doubleThemMutable(arr);  
9  
10 arr; // [6,8,10]
```

```
1 function doubleThemImmutable(list) {  
2     var newList = [];  
3     for (var i=0; i<list.length; i++) {  
4         newList[i] = list[i] * 2;  
5     }  
6     return newList;  
7 }  
8  
9 var arr = [3,4,5];  
10 var arr2 = doubleThemImmutable(arr);  
11  
12 arr;      // [3,4,5]  
13 arr2;     // [6,8,10]
```

CLOSURE

Closure is when a function
"remembers" the variables around
it even when that function is
executed elsewhere.

```
1  function compose2(fn1, fn2) {  
2      return function comp(arg1, arg2, arg3) {  
3          return fn2(  
4              fn1( arg1, arg2 ),  
5                  arg3  
6          );  
7      };  
8  }
```


A diagram illustrating function composition. Two red dashed circles are drawn over the code. The first circle is centered on the arguments *fn1* and *fn2* in the function signature of `compose2` on line 1. The second circle is centered on the arguments *fn1* and *arg3* in the call to `fn2` on line 3. This visualizes how the output of `fn1` is passed as an argument to `fn2`.

```
1  function add(x,y) {
2      return x + y;
3  }
4
5  function curry(fn,...args) {
6      return function(lastArg) {
7          return fn(...args,lastArg);
8      };
9  }
10
11  var addTo10 = curry(add,10);
12
13  addTo10(32);           // 42
```

RECURSION

```
1 function sumIter(sum, ...nums) {  
2     for (var i=0; i<nums.length; i++) {  
3         sum = sum + nums[i];  
4     }  
5     return sum;  
6 }  
7  
8 sumIter(3,4,5,6,7,8,9);           // 42
```

```
1 function sumRecur(sum, ...nums) {  
2     if (nums.length == 0) return sum;  
3     return sum + sumRecur(...nums);  
4 }  
5  
6 sumRecur(3,4,5,6,7,8,9);    // 42
```



PTC

PROPER TAIL CALLS

```
1 function sumRecur(...nums) {
2     return recur(...nums);
3
4     // *****
5     function recur(sum, num, ...nums) {
6         sum += num;
7         if (nums.length == 0) return sum;
8         return recur(sum, ...nums);
9     }
10 }
11
12 sumRecur(3,4,5,6,7,8,9);    // 42
```

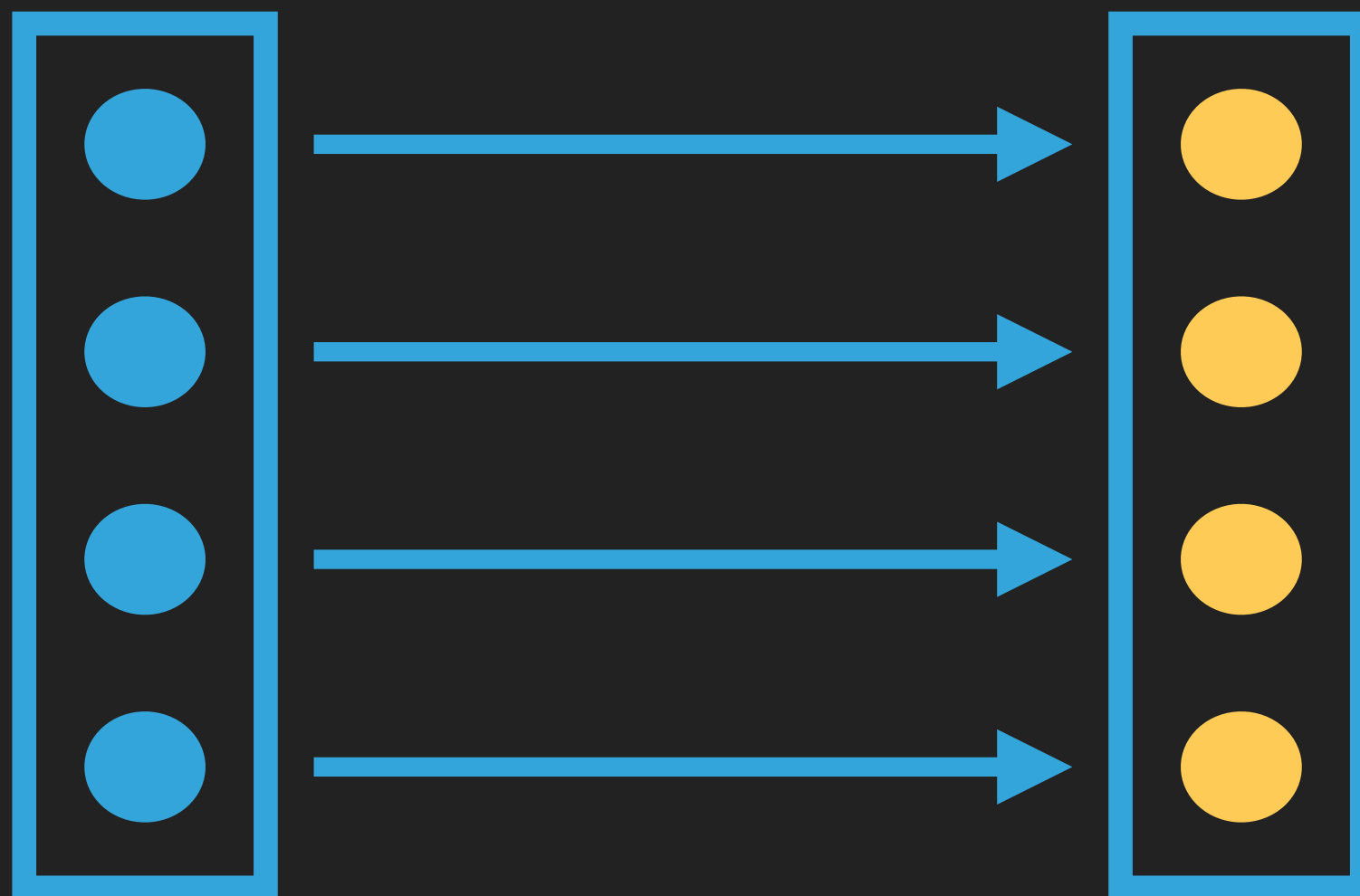


```
1  const sumRecur = (function(){
2      return (...nums) => recur(...nums);
3
4      // *****
5      function recur(sum, num, ...nums) {
6          sum += num;
7          if (nums.length == 0) return sum;
8          return recur(sum, ...nums);
9      }
10 }());
11
12 sumRecur(3,4,5,6,7,8,9);    // 42
```

```
1 function sumRecur(sum, num, ...nums) {  
2     sum += num;  
3     if (nums.length == 0) return sum;  
4     return sumRecur(sum, ...nums);  
5 }  
6  
7 sumRecur(3, 4, 5, 6, 7, 8, 9);    // 42
```

If you can do something awesome,
keep doing it repeatedly.

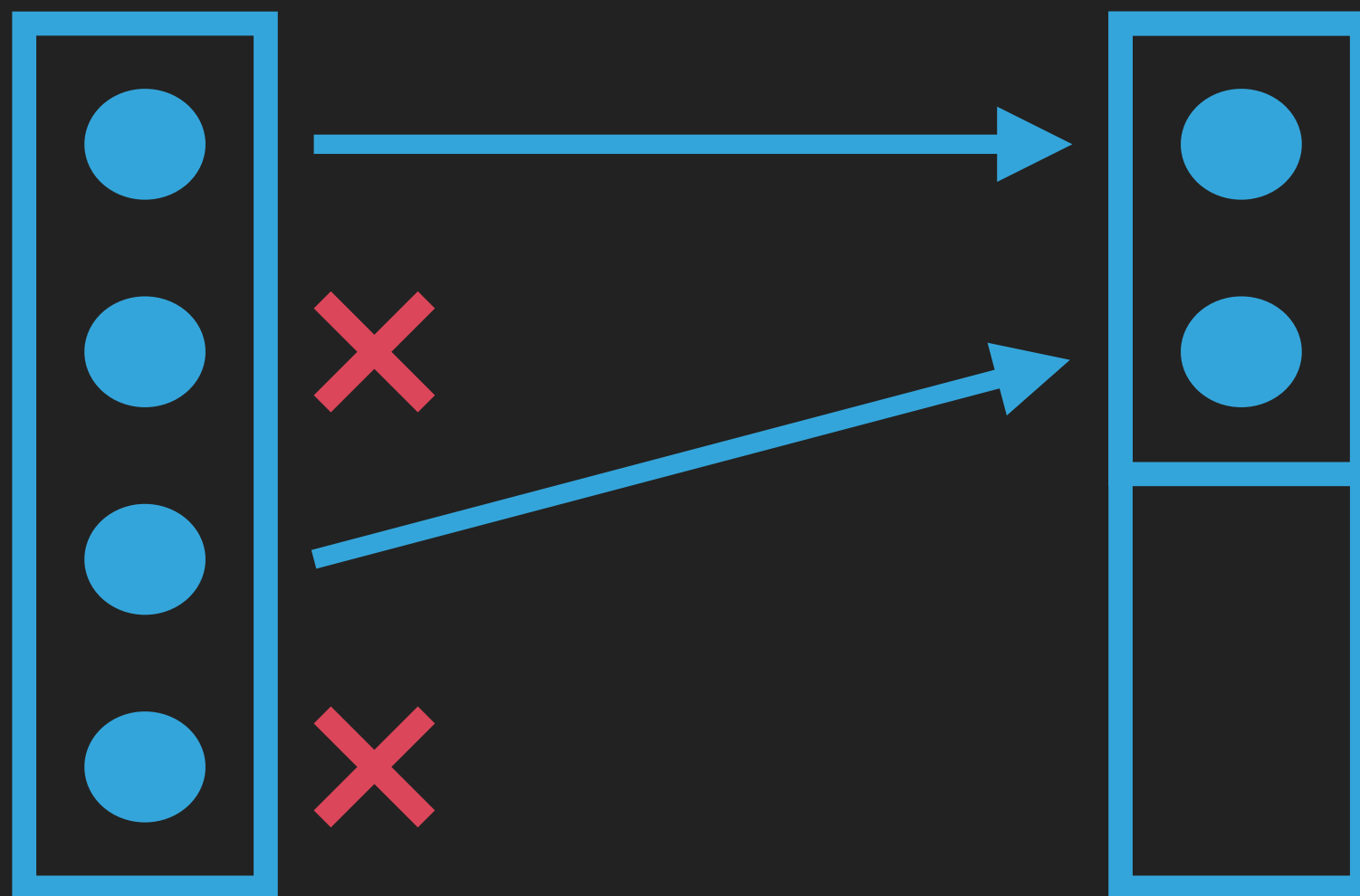
LISTS



MAP: TRANSFORMATION

```
1  function doubleIt(v) { return v * 2; }
2
3  function transform(arr, fn) {
4      var list = [];
5      for (var i=0; i<arr.length; i++) {
6          list[i] = fn(arr[i]);
7      }
8      return list;
9  }
10
11
12  transform([1,2,3,4,5],doubleIt);
13  // [2,4,6,8,10]
```

```
1 function doubleIt(val) {  
2     return val * 2;  
3 }  
4  
5 [1,2,3,4,5].map(doubleIt);  
6 // [2,4,6,8,10]
```

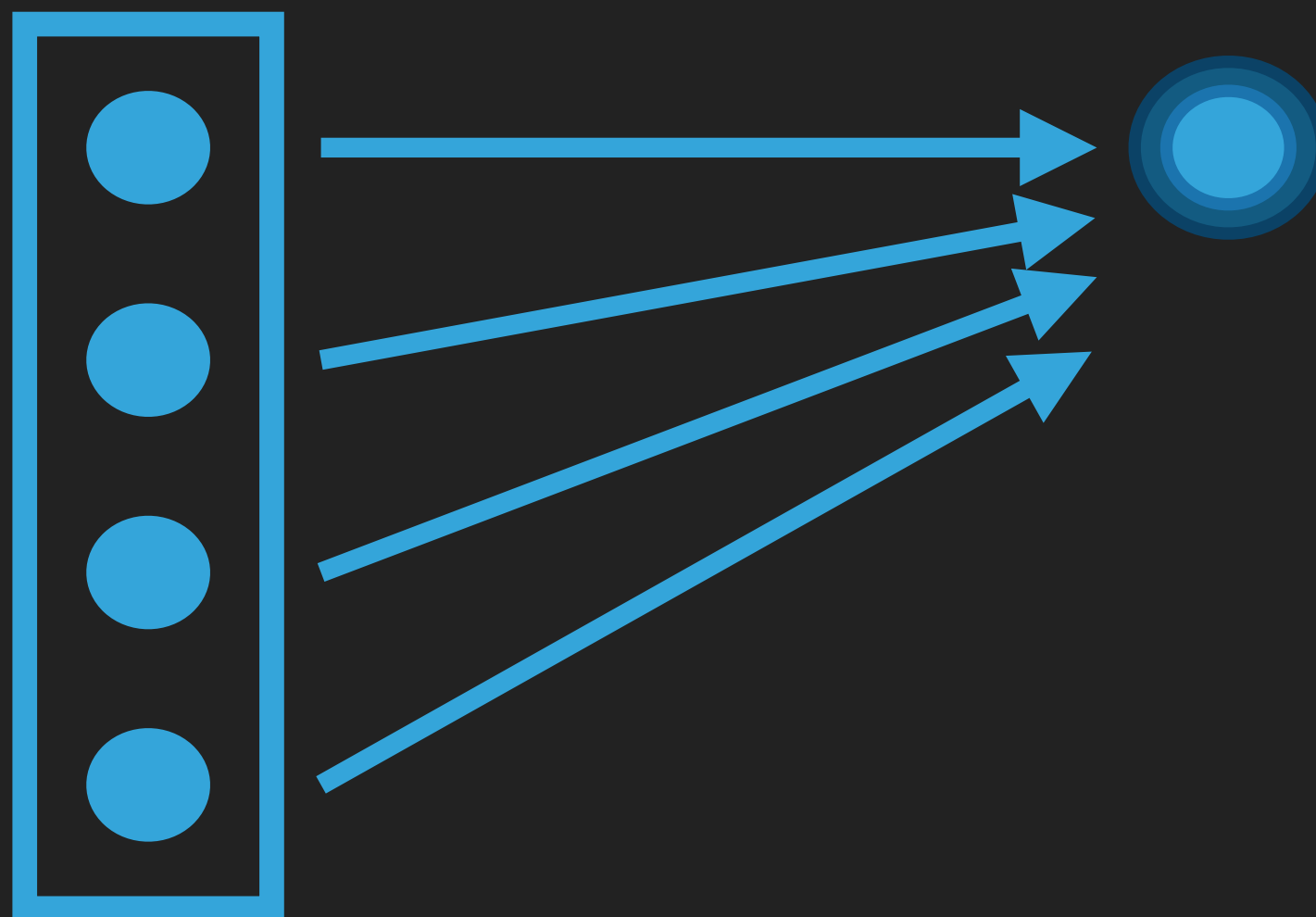


FILTER: EXCLUSION

```
1  function isOdd(v) { return v % 2 == 1; }
2
3  function exclude(arr, fn) {
4      var list = [];
5      for (var i=0; i<arr.length; i++) {
6          if (fn(arr[i])) {
7              list.push(arr[i]);
8          }
9      }
10     return list;
11 }
12
13
14 exclude([1,2,3,4,5], isOdd);
15 // [1,3,5]
```



```
1 function onlyOdds(val) {  
2     return val % 2 == 1;  
3 }  
4  
5 [1,2,3,4,5].filter(onlyOdds);  
6 // [1,3,5]
```



REDUCE: COMBINING

```
1 function mult(x,y) { return x * y; }
2
3 function combine(arr,fn,initial) {
4     var result = initial;
5     for (var i=0; i<arr.length; i++) {
6         result = fn(result,arr[i]);
7     }
8     return result;
9 }
10
11 combine([1,2,3,4,5],mult,1);
12 // 120
```

```
1 function acronym(str, word) {  
2     return str + word.charAt(0);  
3 }  
4  
5 ["Functional", "Light", "JavaScript", "Stuff"]  
6 .reduce(acronym, "");  
7 // FLJS
```

FUSION

```
1 function add1(v) { return v + 1; }
2 function mul2(v) { return v * 2; }
3 function div3(v) { return v / 3; }
4
5 var list = [2,5,8,11,14,17,20];
6
7 list
8 .map( add1 )
9 .map( mul2 )
10 .map( div3 );
11 // [2,4,6,8,10,12,14]
```

```
1 function add1(v) { return v + 1; }
2 function mul2(v) { return v * 2; }
3 function div3(v) { return v / 3; }
4
5 function composeRight(fn1, fn2) {
6     return function(...args){
7         return fn1(fn2(...args));
8     };
9 }
10
11 var list = [2,5,8,11,14,17,20];
12
13 list
14 .map(
15     [div3,mul2,add1].reduce(composeRight)
16 );
17 // [2,4,6,8,10,12,14]
```

TRANSDUCE


```
1 function add1(v) { return v + 1; }
2 function isOdd(v) { return v % 2 == 1; }
3 function sum(total, v) { return total + v; }
4
5 var list = [2,5,8,11,14,17,20];
6
7 list
8 .map( add1 )
9 .filter( isOdd )
10 .reduce( sum );
11 // 48
```

```
1  function mapWithReduce(arr, mappingFn) {
2      return arr.reduce(function reducer(list, v){
3          list.push( mappingFn(v) );
4          return list;
5      }, [] );
6  }
7
8  function filterWithReduce(arr, predicateFn) {
9      return arr.reduce(function reducer(list, v){
10         if (predicateFn(v)) list.push(v);
11         return list;
12     }, [] );
13 }
14
15 var list = [2,5,8,11,14,17,20];
16
17 filterWithReduce(
18     mapWithReduce( list, add1 ),
19     isOdd
20 )
21 .reduce( sum );
22 // 48
```

```
1  function mapReducer(mappingFn) {
2      return function reducer(list,v){
3          list.push( mappingFn(v) );
4          return list;
5      };
6  }
7
8  function filterReducer(predicateFn) {
9      return function reducer(list,v){
10         if (predicateFn(v)) list.push(v);
11         return list;
12     };
13 }
14
15 var list = [2,5,8,11,14,17,20];
16
17 list
18 .reduce( mapReducer(add1), [] )
19 .reduce( filterReducer(isOdd), [] )
20 .reduce( sum );
21 // 48
```

```
1  function listCombination(list, v) {
2      list.push(v);
3      return list;
4  }
5
6  function mapReducer(mappingFn) {
7      return function reducer(list, v) {
8          return listCombination(list, mappingFn(v));
9      };
10 }
11
12 function filterReducer(predicateFn) {
13     return function reducer(list, v) {
14         if (predicateFn(v)) return listCombination(list, v);
15         return list;
16     };
17 }
18
19 var list = [2,5,8,11,14,17,20];
20
21 list
22 .reduce( mapReducer(add1), [] )
23 .reduce( filterReducer(isOdd), [] )
24 .reduce( sum );
25 // 48
```

```
1  function listCombination(list,v) {
2      list.push(v);
3      return list;
4  }
5
6  function mapReducer(mappingFn) {
7      return function toCombine(combineFn){
8          return function reducer(list,v){
9              return combineFn( list, mappingFn(v) );
10         };
11     };
12 }
13
14 function filterReducer(predicateFn) {
15     return function toCombine(combineFn){
16         return function reducer(list,v){
17             if (predicateFn(v)) return combineFn( list, v );
18             return list;
19         };
20     };
21 }
22
23 var list = [2,5,8,11,14,17,20];
24
25 list
26 .reduce( mapReducer(add1)(listCombination), [] )
27 .reduce( filterReducer(isodd)(listCombination), [] )
28 .reduce( sum );
29 // 48
```



```
1  function listCombination(list,v) {
2      list.push(v);
3      return list;
4  }
5
6  function mapReducer(mappingFn) {
7      return function toCombine(combineFn){
8          return function reducer(list,v){
9              return combineFn( list, mappingFn(v) );
10         };
11     };
12 }
13
14 function filterReducer(predicateFn) {
15     return function toCombine(combineFn){
16         return function reducer(list,v){
17             if (predicateFn(v)) return combineFn( list, v );
18             return list;
19         };
20     };
21 }
22
23 var transducer =
24     composeRight( mapReducer(add1), filterReducer(isOdd) )(listCombination);
25
26 var list = [2,5,8,11,14,17,20];
27
28 list
29 .reduce( transducer, [] )
30 .reduce( sum );
31 // 48
```

```
1  function mapReducer(mappingFn) {
2      return function toCombine(combineFn){
3          return function reducer(list,v){
4              return combineFn( list, mappingFn(v) );
5          };
6      };
7  }
8
9  function filterReducer(predicateFn) {
10     return function toCombine(combineFn){
11         return function reducer(list,v){
12             if (predicateFn(v)) return combineFn( list, v );
13             return list;
14         };
15     };
16 }
17
18 var transducer =
19     composeRight( mapReducer(add1), filterReducer(isOdd) )(sum);
20
21 var list = [2,5,8,11,14,17,20];
22
23 list
24 .reduce( transducer, 0)
25 // 48
```

RECAP:

- ▶ Pure Functions (~~side effects~~)
- ▶ Composition
- ▶ Immutability
- ▶ Closure
- ▶ Recursion
- ▶ Lists (map, filter, reduce)
(fusion, transducing)

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