

### Exercise 2.82.

Show how to generalize `apply-generic` to handle coercion in the general case of multiple arguments. One strategy is to attempt to coerce all the arguments to the type of the first argument, then to the type of the second argument, and so on. Give an example of a situation where this strategy (and likewise the two-argument version given above) is not sufficiently general. (Hint: Consider the case where there are some suitable mixed-type operations present in the table that will not be tried.)

### Answer.

The following `apply-generic` procedure handles coercion in the general case of multiple arguments.

```
(define (apply-generic op . args)
  (define (coerce-all type items) ;; coerce all the items in a list to a type
    (if (null? items)
        '()
        (let ((type1 (car items))
              (a1 (car items)))
          (let ((t1->type (get-coercion type1 type)))
            (if (t1->type a1)
                (cons (t1->type a1)
                      (coerce-all type (cdr items)))
                (coerce-all type (cdr items)))))))
  (define (coerced-succeeded? items) ;; determine whether all the items in the
    (= (length items) ;; original list 'args' have been coerced to
        (length args))) ;; the same type
  (let ((type-tags (map type-tag args)))
    (let ((proc (get op type-tags)))
      (if proc
          (apply proc (map contents args))
          (let ((coerced-lists (filter coerced-succeeded?
                                       (map (lambda (arg)
                                             (coerce-all (type-tag arg) args))
                                             args))))
            (if (not (null? coerced-lists))
                (for-each (lambda (l) (apply-generic op . l))
                          coerced-lists)
                (error "No method for these types"
                       (list op type-tags)))))))
```

There are several cases where this strategy might fail to handle. For example, suppose there is a list which contains a real number as the first element and all the subsequent elements of complex numbers. We are now required to stretch the magnitude of all the complex numbers by the value of the real number. Performing this operation using the `apply-generic` procedure above will surely go to a wrong answer. Because the `apply-generic` procedure here only indexes operations of a single type, rather than the ones of mixed-type which the problem belongs to.

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