Chapter One Exercises:

1. Give another possible calculation for the result of double (double 2).

double (double 2)

double (2 + 2)

(2+2) + (2+2)

(2+2) + (4)

(4) + (4)

8

1. Show that sum [x] = x for any number x.

sum(x:xs) = x + sum xs // From the book example

sum [ ] = 0

sum[x] = x ?

sum[x:[]]

= {applying sum}

x + sum[]

= {applying sum}

x + 0

= {applying +}

x

1. Define a product that produces the product of a list of numbers, and showing using your definition that product [2,3,4] = 24.

Product Int -> [Int] -> Int

product[] = 1

product[x:xs] x \* product xs

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Demonstrate that product [2,3,4] = 24

product[2,3,4]

2 \* product[3,4]

2 \* (3 \* product[4])

2 \* (3\* (4 \* product[]) )

2 \* (3 \* (4 \* (1) ) )

2 \* 3 \* (4)

2 \* (12)

24

1. How should the definition of the function qsort be modified so that it produces a reverse sorted version of a list?

The normal definition of qsort is as follows

qsort [] = []

qsort(x:xs) = qsort smaller ++ [x] ++ qsort larger

where

smaller = [a|a <-xs, a <=x]

larger = [b|b <-xs, b > x]

To reverse sort the list, all you would need to change is equivalence relations need to be reversed as demonstrated below.

qsort [] = []

qsort(x:xs) = qsort smaller ++ [x] ++ qsort larger

where

smaller = [a|a <-xs, ***a > x*** ]

larger = [b|b <-xs, ***b <= x*** ]

1. What would be the effect of replace <= by < in the original definition of qsort? Hint: consider the example qsort [2,2,3,1,1].

qsort [] = []

qsort(x:xs) = qsort smaller ++ [x] ++ qsort larger

where

smaller = [a|a <-xs, a < x]

larger = [b|b <-xs, b > x]

qsort[2,2,3,1,1]?

=qsort [1,1] ++ [2] ++ qsort [3]

=(qsort[] ++ [1] ++ qsort[]) ++ [2] ++ (qsort[] ++ [3] ++ qsort[])

=([] ++ [1] ++ []) ++ [2] ++ ([] ++ [3] ++ [])

=[1] ++ [2] ++ [3]

=[1,2,3]

Removing the = in the algorithm will remove all duplicates from the list, as there is no place to sort equivalent values.