Example: Quicksort

Problems:

- What if lo or hi is negative?
- What if hi < lo?
- What if the size of the list is 0?

```
algorithm quicksort(A:List Int, lo:Int, hi:Int) {
   p := partition(A, lo, hi)
   quicksort(A, lo, p)
   quicksort(A, p + 1, hi)
}
```

```
algorithm partition(A:List Int, lo:Int, hi:Int) {
    mid = (lo + hi) / 2
    pivot := A[mid]
    …
}
```

Example: Quicksort

Specification

Program

```
{- lo >= 0 && hi >= 0 -}
{- lo < hi -}
{- length(A) > 0 -}
algorithm quicksort(A:List Int, lo:Int, hi:Int) {
   p := partition(A, lo, hi)
   quicksort(A, lo, p)
   quicksort(A, p + 1, hi)
}
```

```
algorithm partition(A:List Int, lo:Int, hi:Int) {
    mid = (lo + hi) / 2
    pivot := A[mid]
    …
}
```