Name _____ Period _____

Solving Problems

Your Tasks (Mark these off as you go)

- ☐ Find the container with the lowest weight
- ☐ Sort the containers from low to high with respect to their weight
- ☐ Implement a quicksort
- ☐ Compare algorithms
- ☐ Receive credit for this lab guide

☐ Find the container with the lowest weight

Consider eight containers that have different weights. How would you go about finding the container with the lowest weight? Keep in mind the following rules,

- You are only allowed to use a scale to find out how heavy each container is.
- Only two weights can be compared at a time.
- You cannot write down anything

Write your algorithm below. Your algorithm should be written in such a way that another group could implement it.

Obtain 8 containers. Implement your algorithm above to locate the container with the lowest weight. Keep track of how many comparisons you had to make to accomplish this task. Write the number of comparisons below.

□ Sort the containers from low to high with respect to their weight

Brainstorm an algorithm you could use to sort the eight containers from low to high with respect to their weight. Keep in mind the same rules as before,

- You are only allowed to use the scales to find out how heavy each container is.
- Only two weights can be compared at a time.
- You cannot write down anything

Write your algorithm below. Your algorithm should be written in such a way that another group could implement it.

Implement your algorithm above to sort the containers from low to high with respect to their weight. Keep track of how many comparisons you had to make to accomplish this task. Write the number of comparisons below.

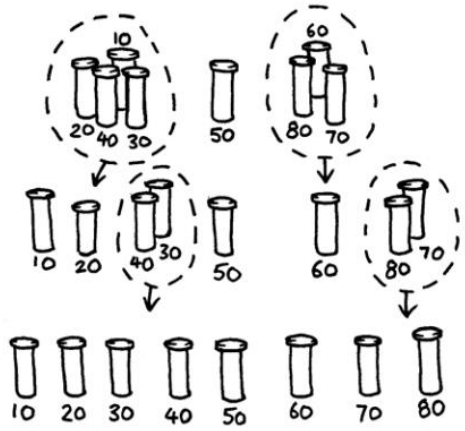
Using your algorithm, how many comparisons would it take to sort 10 containers? 20 containers? 100 containers?

□ Implement a quicksort

Quicksort is probably a lot faster than the sorting algorithm you implemented above, particularly for larger lists. In fact, it is one of the best methods known.

Below is the quicksort algorithm as it applies to our objects,

- Choose one of the objects at random and place it aside.
- Now compare each of the remaining objects with it. Put those that are lighter on the left of the chosen object and those that are heavier on the right. (By chance you may end up with many more objects on one side than on the other.)
- Choose one of the groups and repeat this procedure. Do the same for the other group. Remember to keep the one you know in the center of each group.
- Keep repeating this procedure on the remaining groups until no group has more than one object in it.
- Once all the groups have been divided down to single objects, the objects will be in order from lightest to heaviest.



Mix up your containers and apply the quicksort algorithm above to sort them from low to high with respect to their weights. Keep track of how many comparisons you had to make to accomplish this task. Write the number of comparisons below.

□ Compare algorithms

How did the number of comparisons between your original algorithm and the quicksort algorithm differ?

If you were lucky enough to pick the container with exactly the middle weight each iteration, how many comparisons would it take to sort the containers using the quicksort algorithm?

If you always chose the lightest container for each iteration, how many comparisons would it take to sort the containers using the quicksort algorithm?

□ Receive credit for this lab guide

Submit this portion of the lab to Pluska to receive credit for the lab guide.