**CST8130 – Data Structures – Hybrid Activity #4**

**Name: \_\_\_\_Solutions\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Fill in the following table with BigO order of magnitudes: Given size n for each of :

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Array or ArrayList | Singly linked list with head  (next ref only) | Singly linked list with head and tail (next ref only) | Doubly linked list – head and tail (next and prev references) |
| How much memory for (n) items in list | \*One reference for array  \*one block of n references to data objects  \*n blocks of sizeof data object | \*One reference for head  \*n blocks of 2 references (one for object, one for next)  \*n blocks of sizeof data object | \*One reference for head and one reference for tail  \*n blocks of 2 references (one for object, one for next)  \*n blocks of sizeof data object | \*One reference for head and one reference for tail  \*n blocks of 3 references (one for object, one for next, one for previous)  \*n blocks of sizeof data object |
| Add 1 item to structure (<n)  not in order | O(1)  (add into empty space) | O(1)  (add at head)  O(n) (add at tail) | O(1)  (add at head or tail) | O(1)  (add at head or tail) |
| Add 1 item to structure (>n) not in order | O(n)  (make new array of larger size, copy all old members over then add) | O(1)  (add at head) | O(1)  (add at head or tail) | O(1)  (add at head or tail) |
| Add 1 item to structure (<n) in order | O(logn)  (binary search) | O(n)  (sequential through linked list) | O(n)  (sequential through linked list) | O(n)  (sequential through linked list) |
| Remove 1 item at beginning (head) | O(n)  (need to move all other elements up) | O(1) | O(1) | O(1) |
| Remove 1 item at end (tail) | O(1)  (remove last item in array) | O(n)  (have to go through whole list to end) | O(n)  (still have to go through to set last to null) | O(1) |
| Remove specific item in middle | O(nlogn)  Binary search to find, then O(n) to move rest of items up in array) | O(n)  Sequential search | O(n)  Sequential search | O(n)  Sequential search |
| Sort (best case) if applicable | O(nlogn)  MergeSort or QuickSort | O(n-squared)  No way to get binary break down | O(n-squared)  No way to get binary break down | O(n-squared)  No way to get binary break down |
| Search (best case) | O(logn)  Binary search | O(n)  No way to get to binary | O(n)  No way to get to binary | O(n)  No way to get to binary |