Assignment 6

R-4.14

Bubble sort is stable.

Heap sort is not a stable sort because of upHeaping.

Insertion sort is stable because the value swaps one by one and it doesn't cross once it finds the equal value

Merge sort is not always stable but it can be stable if the first part of the values are always merged to left part and remaining to right part and if it continues the process.

Quicksort is not stable at all because the pivot is chosen randomly and value swaps from both sides.

R-4.16

The bucket sort uses O(n+N) space. Bucket sort moves items to different buckets to get them sorted. As a result, it's not in-place.

C-4.13

Algorithm IsIdentical(A, B, x)

Input: A and B are sequences of n integers	
Output: true if A and B have same elements, false otherwise	
HeapSort(A)	O(n log n)
HeapSort(B)	O(n log n)
For i←0 to i = A.size()-1 do	O(n)
If A.elemAtRank(i) ¬= B.elemAtRank(i) then	O(n)
Return false	O(1)
Return true	O(1)

Total running time is O(n log n)

R-5.4

a) a=2, b=2, f(n) = log n

$\log_b a = 1$

case 1: $\log n \leq n^{1 - \varepsilon}$

True for Ɛ = 0.5

T(n) is Θ(n)

b) a=8, b=2, $f(n) = n^2$

$\log_b a = 3$

case 1: $n^2 \leq n^{3-\varepsilon}$

True for $\varepsilon = 1$

T(n) is $\Theta(n^3)$

c) a=16, b=2, $f(n)= (n \log n)^4$

$\log_b a = 4$

Case 1: $(n \log n)^4 \leq n^{4-\varepsilon}$

Not true for $\varepsilon > 0$

Case 2: $(n \log n)^4 = n^4 \log^k n$

True for k = 4

T(n) is $\Theta(n^4 \log^5 n)$

d) a=7, b=3, f(n) = n

$\log_b a = 1.7712$

Case 1: $n \leq n^{1.7712-\varepsilon}$

True for $\varepsilon = 0.7712$

T(n) is $\Theta(n^{1.7712})$

e) a=9, b=3, $f(n)= n^3 \log n$

$\log_b a = 2$

Case 1: $n^3 \log n \leq n^{2-\varepsilon}$

Not true for $\varepsilon > 0$

Case 2: $n^3 \log n = n^2 \log^k n$

Not true

Case 3: $n^3 \log n \geq n^{2+\varepsilon}$

True for $\varepsilon = 1$

$9 (n/3)^3 \log (n/3) \leq \delta n^3 \log n$

$1/3\ n^3 (\log n - \log 3) \leq \delta n^3 \log n$

$\delta = 1/3$, T(n) is $\Theta(n^3 \log n)$