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CS325 Assignment 2

1.

a. T(n) = 3T(n-1)+1

Using the muster method, a=3, b=1, f(n) = n^0, d = 0

Since a>1,

T(n) = Θ ($n^0 3^{\frac{n}{1}}$) = Θ(3^n)

b. T(n) = T(n-2)+2

Using the muster method, a=1, b=2, f(n) = 2 = $2n^0$, d=0

Since a=1,

T(n) = Θ(n)

c. T(n) = 9T($\frac{n}{3}$) + $6n^2$

Using the master method, a=9, b=3, f(n) = $6n^2, \log_3 9 = 2$

We would use case 2 since f(n)=Θ(n^2)

T(n) = Θ($n^2 lgn$)

d. T(n) = 2T($\frac{n}{4}$) + $2n^2$

Using the master method, a=2, b=4, f(n) = $2n^2, \log_4 2 = \frac{1}{2}$

We would use case 3 since f(n) = Ω($n^{\frac{1}{2}}$)

T(n) = Θ(n^2)

2.

a. The algorithm will compare what is being searched for with the n/3 and the 2n/3 element. If the item being searched for is less than n/3, then it will call itself using elements 0 to n/3. If the item being searched for is greater than 2n/3, then it will call itself using elements 2n/3 to n. Otherwise it will call itself on (n/3) + 1 to (2n/3) – 1. It will continue doing this until the item has been found or it cannot search anymore.

```
bool ternarySearch(array, beginning, end, item){
    int firstThird = beginning  + ceiling((end-beginning/3))
    int secondThird = end – ceiling((end-beginning/3))
    if (item == array[firstThird] || item == array[secondThird])
        return true
    if (item < array[firstThird] )
        return ternarySearch(array, beginning, firstThird – 1, item)
    else if (item > array[secondThird])
        return ternarySearch(array, secondThird+1, end, item)
    else
        return ternarySearch(array, firstThird+1, secondThird-1, item)
    return false
```

b. T(n) = T(n/3) + c

c. T(n) = T(n/3) + c

Using the master method, a=1, b=3, f(n) = c, $\log_3 1 = 0$

Since f(n) = Θ(n^0), we use case 2

T(n) = Θ(lgn)

3.

a. T(n) = 3T(2n/3) + c

b. Using the master method, a=3, b=3/2, f(n) = c, $\log_{\frac{3}{2}} 3 = 2.71$

Since f(n) = O($n^{2.71}$), we use case 1

T(n) = Θ($n^{2.71}$)

4.

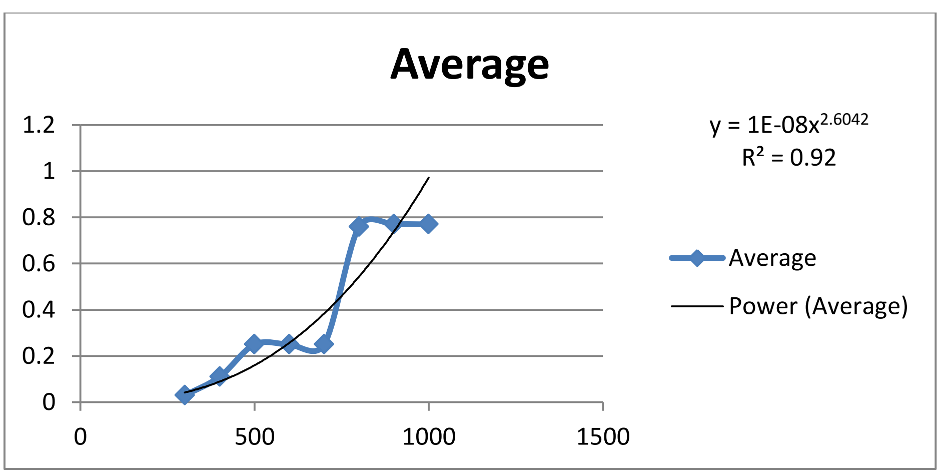
a. Submission on teach

b. Submission on teach

c. All times will be in seconds

N	Trial 1	Trial 2	Trial 3	Average
300	.03	.02	.03	.03
400	.08	.17	.08	.11
500	.25	.25	.26	.25
600	.25	.25	.25	.25
700	.25	.25	.26	.25
800	.77	.77	.75	.76
900	.78	.76	.76	.77
1000	.76	.77	.78	.77

d. The equation that best fits the graph is $.000000001x^{2.6042}$



e. Average experimental running time is $\Theta(n^{2.71})$. My graph was $\Theta(n^{2.6})$ which was close to the experimental value.

f. Did not do assignment 1, so unable to plot data together