Data Structures – Project Report 2

Assigned: **June 6, 2019**
Due Date: **June 20, 2019**

Group Letter ㄴ

Please write the names of everyone who worked on this assignment.

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This assignment should be completed together with your team. Each team should do this only once. Please print this and submit it in class.

1) Write down your data for the XTREE

   Please write down the amount of time needed to run each Experiment:

Value of n	100	200	300	400	500
Experiment 1	0.00035103	0.00061838	0.00125691	0.00215149	0.00327513
Experiment 2	0.00021708	0.00025524	0.00031165	0.00035418	0.00040528
Experiment 3	0.00000131	0.00000252	0.00000377	0.00000491	0.00000624
Experiment 4	0.00003963	0.00013764	0.00032997	0.00062434	0.00103579
Experiment 5	0.00000034	0.00000039	0.00000040	0.00000044	0.00000044
Experiment 6	0.00000260	0.00000544	0.00000858	0.00001155	0.00001526
Experiment 7	0.00000005	0.00000005	0.00000006	0.00000006	0.00000006
Experiment 8	0.00000067	0.00000126	0.00000182	0.00000241	0.00000314
Experiment 9	0.00000034	0.00000042	0.00000044	0.00000046	0.00000046
Experiment 10	0.00000248	0.00000518	0.00000832	0.00001127	0.00001448
Experiment 11	0.00000114	0.00000168	0.00000225	0.00000308	0.00000354
Experiment 12	0.00002163	0.00007933	0.00018231	0.00030994	0.00049759

Value of n	100	200	300	400	500
Experiment 13	0.00000053	0.00000061	0.00000072	0.00000075	0.00000078
Experiment 14	0.00000919	0.00002047	0.00003182	0.00004429	0.00005647

2) Use the above timings to derive a formula for the amount of time each experiment requires

Experiment 1	T(n) =1.8*10^-6nlogn	T(n) = Θ(nlogn)
Experiment 2	T(n) =4*10^-6nlogn	T(n) = Θ(nlogn)
Experiment 3	T(n) =0.000131n	T(n) = Θ(n)
Experiment 4	T(n) =0.3963n^2	T(n) = Θ(n^2)
Experiment 5	T(n) =log(3.3*10^-3)n	T(n) = Θ(logn)
Experiment 6	T(n) =nlog(3.3*10^-3)n	T(n) = Θ(nlogn)
Experiment 7	T(n) =0.000000002n	T(n) = Θ(n)
Experiment 8	T(n) =0.0000006n	T(n) = Θ(n)
Experiment 9	T(n) =log(0.0100000078)n	T(n) = Θ(logn)
Experiment 10	T(n) =nlog(0.0100000078)n	T(n) = Θ(nlogn)
Experiment 11	T(n) =5*10^-7n	T(n) = Θ(n)
Experiment 12	T(n) =1.5*10^-4n	T(n) = Θ(n)
Experiment 13	T(n) =2.9logn	T(n) = Θ(logn)
Experiment 14	T(n) =1.15*10^-5n	T(n) = Θ(n)

3) Based on these Experiments, what do you think are the Running times of Insert and Search in the XTree? If you cannot determine the answer, then write "Unknown"

Operation	Best	Average	Amortized	Worst
Insert	Θ(1)	Θ(logn)	Θ(n)	Θ(n)
Search	Θ(1)	Θ(logn)	Θ(n)	Θ(n)

4) Based on these Running Times, do you think the XTree is a Binary Search Tree (BST), an AVL Tree, or a Splay Tree? Explain your decision. **We think XTree is BST.**

5) Write down your data for the YTREE

Please write down the amount of time needed to run each Experiment:

Value of n	100	200	300	400	500
Experiment 1	0.00019329	0.00020783	0.00021412	0.00022509	0.00022866
Experiment 2	0.00023632	0.00030893	0.00037899	0.00036901	0.00043643
Experiment 3	0.00000006	0.00000006	0.00000006	0.00000006	0.00000006
Experiment 4	0.00000130	0.00000244	0.00000364	0.00000478	0.00000595
Experiment 5	0.00000083	0.00000105	0.00000110	0.00000118	0.00000121
Experiment 6	0.00000219	0.00000372	0.00000510	0.00000668	0.00000772
Experiment 7	0.00000529	0.00001055	0.00001585	0.00002092	0.00002613
Experiment 8	0.00000596	0.00001208	0.00001874	0.00002426	0.00003029
Experiment 9	0.00000081	0.00000100	0.00000117	0.00000120	0.00000122
Experiment 10	0.00000179	0.00000293	0.00000401	0.00000486	0.00000580
Experiment 11	0.00000304	0.00000578	0.00000824	0.00001093	0.00001343
Experiment 12	0.00000561	0.00001083	0.00001589	0.00002086	0.00002633
Experiment 13	0.00000107	0.00000133	0.00000149	0.00000166	0.00000182
Experiment 14	0.00000879	0.00001416	0.00001868	0.00002269	0.00002655

6) Use the above timings to derive a formula for the amount of time each experiment requires

Experiment 1	T(n) =2.16*10^-6nlogn	T(n) = Θ(nlogn)
Experiment 2	T(n) =6*10^-6nlogn	T(n) = Θ(nlogn)
Experiment 3	T(n) =0.00000006	T(n) = Θ(1)
Experiment 4	T(n) =0.00013n	T(n) = Θ(n)
Experiment 5	T(n) =log(3.3*10^-3)n	T(n) = Θ(logn)
Experiment 6	T(n) =0.000219n	T(n) = Θ(n)
Experiment 7	T(n) =0.00000054n	T(n) = Θ(n)
Experiment 8	T(n) =0.00000053n	T(n) = Θ(n)
Experiment 9	T(n) =log(0.0100000186)n	T(n) = Θ(logn)
Experiment 10	T(n) =nlog(0.0100000186)n	T(n) = Θ(nlogn)
Experiment 11	T(n) =2*10^-6n	T(n) = Θ(n)
Experiment 12	T(n) =5*10^-6n	T(n) = Θ(n)
Experiment 13	T(n) =6.5*10^-7logn	T(n) = Θ(logn)
Experiment 14	T(n) =4.5*10^-5n	T(n) = Θ(n)

7) Based on these Experiments, what do you think are the Running times of Insert and Search in the YTree? If you cannot determine the answer, then write "Unknown"

Operation	**Best**	**Average**	**Amortized**	**Worst**
Insert	Θ(1)	Θ(logn)	Θ(logn)	Θ(n)
Search	Θ(1)	Θ(logn)	Θ(logn)	Θ(n)

8) Based on these Running Times, do you think the YTree is a Binary Search Tree (BST), an AVL Tree, or a Splay Tree? Explain your decision.**We think YTree is a Splay Tree.**

9) Write down your data for the ZTREE

Please write down the amount of time needed to run each Experiment:

Value of n	**100**	**200**	**300**	**400**	**500**
Experiment 1	0.00022157	0.00025930	0.00031743	0.00034026	0.00035451
Experiment 2	0.00024845	0.00025444	0.00033374	0.00035976	0.00040755
Experiment 3	0.00000039	0.00000048	0.00000051	0.00000054	0.00000055
Experiment 4	0.00000324	0.00000681	0.00001109	0.00001483	0.00001827
Experiment 5	0.00000041	0.00000048	0.00000051	0.00000055	0.00000060
Experiment 6	0.00000303	0.00000654	0.00001000	0.00001372	0.00001756
Experiment 7	0.00000045	0.00000054	0.00000054	0.00000061	0.00000061
Experiment 8	0.00000311	0.00000686	0.00000981	0.00001477	0.00001834
Experiment 9	0.00000040	0.00000049	0.00000054	0.00000057	0.00000060
Experiment 10	0.00000299	0.00000652	0.00001014	0.00001402	0.00001792
Experiment 11	0.00000039	0.00000047	0.00000051	0.00000055	0.00000056
Experiment 12	0.00000705	0.00001564	0.00002468	0.00003418	0.00004442
Experiment 13	0.00000046	0.00000054	0.00000063	0.00000064	0.00000067
Experiment 14	0.00000809	0.00001808	0.00002891	0,00004041	0,00005216

10) Use the above timings to derive a formula for the amount of time each experiment requires

Experiment 1	T(n) =2.68*10^-6nlogn	T(n) = Θ(nlogn)
Experiment 2	T(n) =4.5*10^-6nlogn	T(n) = Θ(nlogn)
Experiment 3	T(n) =log(3.3*10^-3)n	T(n) = Θ(logn)
Experiment 4	T(n) =nlog(3.3*10^-3)n	T(n) = Θ(nlogn)
Experiment 5	T(n) =log(3.3*10^-3)n	T(n) = Θ(logn)
Experiment 6	T(n) =nlog(3.3*10^-3)n	T(n) = Θ(nlogn)
Experiment 7	T(n) =log(0.003333337478)n	T(n) = Θ(logn)
Experiment 8	T(n) =log(0.003333408629)n	T(n) = Θ(nlogn)
Experiment 9	T(n) =log(0.0100000092)n	T(n) = Θ(logn)
Experiment 10	T(n) =nlog(0.0100000092)n	T(n) = Θ(nlogn)
Experiment 11	T(n) =2*10^-7logn	T(n) = Θ(logn)
Experiment 12	T(n) =8*10^-7n	T(n) = Θ(n)
Experiment 13	T(n) =2.5*10^-7logn	T(n) = Θ(logn)
Experiment 14	T(n) =10^-5n	T(n) = Θ(n)

11) Based on these Experiments, what do you think are the Running times of Insert and Search in the ZTree? If you cannot determine the answer, then write "Unknown"

Operation	**Best**	**Average**	**Amortized**	**Worst**
Insert	Θ(logn)	Θ(logn)	Θ(logn)	Θ(logn)
Search	Θ(1)	Θ(logn)	Θ(logn)	Θ(logn)

12) Based on these Running Times, do you think the ZTree is a Binary Search Tree (BST), an AVL Tree, or a Splay Tree? Explain your decision.**We think ZTree is an AVL Tree.**