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Database Management Systems

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Performance Comparisons

Manuel Execution Time Trials (No Stored Procedure)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Query Type** | **Description** | **Dataset Size** | **Index Type** | **Microseconds** |
| **Point Query 1** | SELECT count(\*) FROM accounts WHERE branch\_name = "Downtown" AND balance = 50000 | 50,000 | Without Indexes | 23949 |
|  |  |  |  | 24278 |
|  |  |  |  | 25131 |
|  |  |  |  | 23765 |
|  |  |  |  | 23024 |
|  |  |  |  | 26871 |
|  |  |  |  | 26820 |
|  |  |  |  | 24612 |
|  |  |  |  | 24334 |
|  |  |  |  | 26093 |
| **Point Query 1** | SELECT count(\*) FROM accounts WHERE branch\_name = "Downtown" AND balance = 50000 | 50,000 | With Indexes (branch and balance) | 15254 |
|  |  |  |  | 6961 |
|  |  |  |  | 7895 |
|  |  |  |  | 8969 |
|  |  |  |  | 10005 |
|  |  |  |  | 8111 |
|  |  |  |  | 7042 |
|  |  |  |  | 9296 |
|  |  |  |  | 8848 |
|  |  |  |  | 8862 |
| **Point Query 2** | SELECT count(\*) FROM accounts  WHERE account\_type = 'Savings'  AND balance = 90000; | 100,000 | Without Indexes | 42794 |
|  |  |  |  | 71635 |
|  |  |  |  | 47724 |
|  |  |  |  | 50128 |
|  |  |  |  | 42984 |
|  |  |  |  | 48378 |
|  |  |  |  | 51008 |
|  |  |  |  | 50677 |
|  |  |  |  | 55340 |
|  |  |  |  | 46632 |
| **Point Query 2** | SELECT count(\*) FROM accounts  WHERE account\_type = 'Savings'  AND balance = 90000 | 100,000 | With Indexes (account type and balance) | 7479 |
|  |  |  |  | 11561 |
|  |  |  |  | 9243 |
|  |  |  |  | 11834 |
|  |  |  |  | 8313 |
|  |  |  |  | 11483 |
|  |  |  |  | 7986 |
|  |  |  |  | 8362 |
|  |  |  |  | 7006 |
|  |  |  |  | 8953 |
| **Point Query 3** | SELECT count(\*) FROM accounts  WHERE balance = 5000; | 150,000 | Without Indexes | 45888 |
|  |  |  |  | 47163 |
|  |  |  |  | 60127 |
|  |  |  |  | 56435 |
|  |  |  |  | 53900 |
|  |  |  |  | 49967 |
|  |  |  |  | 50693 |
|  |  |  |  | 51037 |
|  |  |  |  | 49841 |
|  |  |  |  | 50488 |
| **Point Query 3** | SELECT count(\*) FROM accounts  WHERE balance = 5000; | 150,000 | With Indexes (balance) | 6612 |
|  |  |  |  | 9314 |
|  |  |  |  | 7394 |
|  |  |  |  | 8652 |
|  |  |  |  | 9752 |
|  |  |  |  | 7821 |
|  |  |  |  | 9567 |
|  |  |  |  | 8680 |
|  |  |  |  | 7660 |
|  |  |  |  | 8519 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Range Query 1** | SELECT count(\*) FROM accounts  WHERE branch\_name = 'Downtown'  AND balance BETWEEN 50000 AND 100000; | 50,000 | Without Indexes | 28584 |
|  |  |  |  | 24548 |
|  |  |  |  | 42978 |
|  |  |  |  | 24028 |
|  |  |  |  | 26815 |
|  |  |  |  | 27437 |
|  |  |  |  | 27756 |
|  |  |  |  | 25867 |
|  |  |  |  | 29119 |
|  |  |  |  | 23744 |
| **Range Query 1** | SELECT count(\*) FROM accounts  WHERE branch\_name = 'Downtown'  AND balance BETWEEN 50000 AND 100000; | 50,000 | With Indexes (branch and balance) | 34024 |
|  |  |  |  | 37899 |
|  |  |  |  | 33376 |
|  |  |  |  | 41817 |
|  |  |  |  | 35509 |
|  |  |  |  | 36480 |
|  |  |  |  | 41888 |
|  |  |  |  | 39769 |
|  |  |  |  | 36628 |
|  |  |  |  | 33272 |
| **Range Query 2** | SELECT count(\*) FROM accounts  WHERE account\_type = 'Savings'  AND balance BETWEEN 90000 AND 100000; | 100,000 | Without Indexes | 45228 |
|  |  |  |  | 49967 |
|  |  |  |  | 47663 |
|  |  |  |  | 45524 |
|  |  |  |  | 48393 |
|  |  |  |  | 52290 |
|  |  |  |  | 48609 |
|  |  |  |  | 49811 |
|  |  |  |  | 47079 |
|  |  |  |  | 49176 |
| **Range Query 2** | SELECT count(\*) FROM accounts  WHERE account\_type = 'Savings'  AND balance BETWEEN 90000 AND 100000; | 100,000 | With Indexes (balance and account type) | 174671 |
|  |  |  |  | 181487 |
|  |  |  |  | 172729 |
|  |  |  |  | 177214 |
|  |  |  |  | 166669 |
|  |  |  |  | 174498 |
|  |  |  |  | 163904 |
|  |  |  |  | 170704 |
|  |  |  |  | 180283 |
|  |  |  |  | 168030 |
| **Range Query 3** | SELECT count(\*) FROM accounts  WHERE balance BETWEEN 1000 AND 5000; | 150,000 | Without Indexes | 55852 |
|  |  |  |  | 64591 |
|  |  |  |  | 60284 |
|  |  |  |  | 58964 |
|  |  |  |  | 64618 |
|  |  |  |  | 64151 |
|  |  |  |  | 56278 |
|  |  |  |  | 60223 |
|  |  |  |  | 60227 |
|  |  |  |  | 63473 |
| **Range Query 3** | SELECT count(\*) FROM accounts  WHERE balance BETWEEN 1000 AND 5000; | 150,000 | With Indexes (balance) | 9826 |
|  |  |  |  | 13696 |
|  |  |  |  | 10178 |
|  |  |  |  | 12986 |
|  |  |  |  | 11672 |
|  |  |  |  | 12515 |
|  |  |  |  | 11165 |
|  |  |  |  | 11128 |
|  |  |  |  | 11757 |
|  |  |  |  | 10789 |

Stored Procedures (Average Execution Time)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Query Type** | **Description** | **Dataset Size** | **Index Type** | **Average Microseconds** |
| **Point Query 1** | SELECT count(\*) FROM accounts WHERE account\_type = "Savings" AND balance = 89780.22; | 50,000 | Without Indexes | 16015.6 |
|  |  |  | With Indexes (branch and balance) | 390.7 |
| **Point Query 2** | SELECT count(\*) FROM accounts WHERE balance = 20000 | 100,000 | Without Indexes | 25390.6 |
|  |  |  | With Indexes | 390.6 |
| **Point Query 3** | SELECT count(\*) FROM accounts  WHERE balance = 5000; | 150,000 | Without Indexes | 39843.7 |
|  |  |  | With Indexes | 390.6 |
| **Range Query 1** | SELECT count(\*) FROM accounts  WHERE branch\_name = 'Downtown'  AND balance BETWEEN 50000 AND 100000; | 50,000 | Without Indexes | 16796.9 |
|  |  |  | With Indexes | 10156.2 |
| **Range Query 2** | SELECT count(\*) FROM accounts  WHERE account\_type = 'Savings'  AND balance BETWEEN 90000 AND 100000; | 100,000 | Without Indexes | 38671.8 |
|  |  |  | With Indexes | 38281.2 |
| **Range Query 3** | SELECT count(\*) FROM accounts  WHERE balance BETWEEN 1000 AND 5000; | 150,000 | Without Indexes | 50781.3 |
|  |  |  | With Indexes | 3125 |

A graph with numbers and points

Description automatically generated

A graph with numbers and dots

Description automatically generated

Looking at the results for both the manual and stored procedures time trials, it becomes clear that indexes usually speed up execution time exponentially. Where the use of indexing always speeds up the process in point queries, indexing does not seem to make a tangible difference in range queries until the dataset includes 150,000 records. During manual execution, indexing even sometimes slowed down the execution of range queries slightly. However, during the stored procedure, it always sped up the process, but once again did not make a noticeable difference in execution time until 150,000 records were used. Despite these results for range queries, indexing did make an extremely big difference in range queries. Where without indexes the execution time grew somewhat linearly with the dataset sizes, the use of indexing in point queries led to a constant execution time despite growing dataset sizes.