**Nirmal Kumar Sedhumadhavan**

**ECE 786 Final Project**

**Task 1 - Cache Efficiency Analysis**

Formula used to calculate Percentage change of comparing the IPC with / without cache bypassing.

(IPC with cache bypassing – IPC with no cache bypassing) \* 100 / IPC with no cache bypassing

Assumptions for benchmark category

* less than 0% is Cache Friendly.
* 0 - 5% difference is Cache Insensitive.
* More than 5% Cache Unfriendly.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Benchmark name | kernel\_name | kernel\_  launch \_uid | IPC with no cache bypassing | IPC with cache bypassing | Percentage change | benchmark category |
| Rodinia | | | | | | |
| HS | \_Z14calculate\_tempiPfS\_S\_iiiiffffff | 1 | 701.3718 | 707.6299 | 0.8923 | Cache Insensitive |
| BP | \_Z22bpnn\_layerforward\_CUDAPfS\_S\_S\_ii | 1 | 670.1913 | 666.3648 | -0.571 | Cache Insensitive |
| BP | \_Z24bpnn\_adjust\_weights\_cudaPfiS\_iS\_S\_ | 2 | 424.712 | 192.2678 | -54.7298 | Cache Friendly |
| LUD | \_Z12lud\_diagonalPfii | 1 | 0.7026 | 0.7176 | 2.1349 | Cache Insensitive |
| LUD | \_Z13lud\_perimeterPfii | 2 | 9.2446 | 9.1103 | -1.4527 | Cache Insensitive |
| LUD | \_Z12lud\_internalPfii | 3 | 501.2445 | 567.1572 | 13.1498 | Cache Unfriendly |
| LUD | \_Z12lud\_diagonalPfii | 4 | 0.7558 | 0.7742 | 2.4345 | Cache Insensitive |
| LUD | \_Z13lud\_perimeterPfii | 5 | 10.9464 | 11.8102 | 7.8912 | Cache Unfriendly |
| LUD | \_Z12lud\_internalPfii | 6 | 497.3745 | 574.7466 | 15.5561 | Cache Unfriendly |
| LUD | \_Z12lud\_diagonalPfii | 7 | 0.7558 | 0.7741 | 2.4213 | Cache Insensitive |
| LUD | \_Z13lud\_perimeterPfii | 8 | 10.1697 | 10.9718 | 7.8872 | Cache Unfriendly |
| LUD | \_Z12lud\_internalPfii | 9 | 473.0808 | 557.2787 | 17.7978 | Cache Unfriendly |
| LUD | \_Z12lud\_diagonalPfii | 10 | 0.7558 | 0.7741 | 2.4213 | Cache Insensitive |
| LUD | \_Z13lud\_perimeterPfii | 11 | 9.3893 | 10.1287 | 7.8749 | Cache Unfriendly |
| LUD | \_Z12lud\_internalPfii | 12 | 462.4784 | 529.6388 | 14.5218 | Cache Unfriendly |
| LUD | \_Z12lud\_diagonalPfii | 13 | 0.7558 | 0.7741 | 2.4213 | Cache Insensitive |
| LUD | \_Z13lud\_perimeterPfii | 14 | 8.6082 | 9.2874 | 7.8902 | Cache Unfriendly |
| LUD | \_Z12lud\_internalPfii | 15 | 378.4012 | 504.6895 | 33.3742 | Cache Unfriendly |
| LUD | \_Z12lud\_diagonalPfii | 16 | 0.7558 | 0.7742 | 2.4345 | Cache Insensitive |
| LUD | \_Z13lud\_perimeterPfii | 17 | 7.8294 | 8.4467 | 7.8844 | Cache Unfriendly |
| LUD | \_Z12lud\_internalPfii | 18 | 357.2093 | 493.737 | 38.2206 | Cache Unfriendly |
| LUD | \_Z12lud\_diagonalPfii | 19 | 0.7558 | 0.7742 | 2.4345 | Cache Insensitive |
| LUD | \_Z13lud\_perimeterPfii | 20 | 7.0473 | 7.604 | 7.8995 | Cache Unfriendly |
| LUD | \_Z12lud\_internalPfii | 21 | 338.0277 | 453.3258 | 34.1091 | Cache Unfriendly |
| LUD | \_Z12lud\_diagonalPfii | 22 | 0.7558 | 0.7741 | 2.4213 | Cache Insensitive |
| LUD | \_Z13lud\_perimeterPfii | 23 | 6.264 | 6.7609 | 7.9326 | Cache Unfriendly |
| LUD | \_Z12lud\_internalPfii | 24 | 324.1251 | 467.1097 | 44.114 | Cache Unfriendly |
| LUD | \_Z12lud\_diagonalPfii | 25 | 0.7558 | 0.7741 | 2.4213 | Cache Insensitive |
| LUD | \_Z13lud\_perimeterPfii | 26 | 5.4832 | 5.9163 | 7.8987 | Cache Unfriendly |
| LUD | \_Z12lud\_internalPfii | 27 | 290.9933 | 405.2074 | 39.2497 | Cache Unfriendly |
| LUD | \_Z12lud\_diagonalPfii | 28 | 0.7558 | 0.7741 | 2.4213 | Cache Insensitive |
| LUD | \_Z13lud\_perimeterPfii | 29 | 4.7006 | 5.0733 | 7.9288 | Cache Unfriendly |
| LUD | \_Z12lud\_internalPfii | 30 | 246.8571 | 344.3503 | 39.4938 | Cache Unfriendly |
| LUD | \_Z12lud\_diagonalPfii | 31 | 0.7558 | 0.7741 | 2.4213 | Cache Insensitive |
| LUD | \_Z13lud\_perimeterPfii | 32 | 3.9172 | 4.2288 | 7.9547 | Cache Unfriendly |
| LUD | \_Z12lud\_internalPfii | 33 | 208.6225 | 253.2766 | 21.4043 | Cache Unfriendly |
| LUD | \_Z12lud\_diagonalPfii | 34 | 0.7558 | 0.7741 | 2.4213 | Cache Insensitive |
| LUD | \_Z13lud\_perimeterPfii | 35 | 3.1348 | 3.3833 | 7.9271 | Cache Unfriendly |
| LUD | \_Z12lud\_internalPfii | 36 | 142.2966 | 172.1319 | 20.967 | Cache Unfriendly |
| LUD | \_Z12lud\_diagonalPfii | 37 | 0.7558 | 0.7741 | 2.4213 | Cache Insensitive |
| LUD | \_Z13lud\_perimeterPfii | 38 | 2.3514 | 2.5387 | 7.9655 | Cache Unfriendly |
| LUD | \_Z12lud\_internalPfii | 39 | 111.9498 | 134.8471 | 20.4532 | Cache Unfriendly |
| LUD | \_Z12lud\_diagonalPfii | 40 | 0.7558 | 0.7741 | 2.4213 | Cache Insensitive |
| LUD | \_Z13lud\_perimeterPfii | 41 | 1.5679 | 1.6926 | 7.9533 | Cache Unfriendly |
| LUD | \_Z12lud\_internalPfii | 42 | 39.4499 | 44.9208 | 13.868 | Cache Unfriendly |
| LUD | \_Z12lud\_diagonalPfii | 43 | 0.7558 | 0.7741 | 2.4213 | Cache Insensitive |
| LUD | \_Z13lud\_perimeterPfii | 44 | 0.8583 | 0.8467 | -1.3515 | Cache Insensitive |
| LUD | \_Z12lud\_internalPfii | 45 | 16.2623 | 16.6957 | 2.6651 | Cache Insensitive |
| LUD | \_Z12lud\_diagonalPfii | 46 | 0.7558 | 0.7741 | 2.4213 | Cache Insensitive |
|  | | | | | | |
| ISPASS | | | | | | |
| NQU | \_Z24solve\_nqueen\_cuda\_kerneliiPjS\_S\_S\_i | 1 | 30.4185 | 30.7699 | 1.1552 | Cache Insensitive |
| LPS | \_Z13GPU\_laplace3diiiiPfS\_ | 1 | 383.1095 | 408.8568 | 6.7206 | Cache Unfriendly |
| BFS | \_Z6KernelP4NodePiPbS2\_S1\_S2\_i | 1 | 217.5687 | 167.9066 | -22.8259 | Cache Friendly |
| BFS | \_Z6KernelP4NodePiPbS2\_S1\_S2\_i | 2 | 206.0139 | 146.9099 | -28.6893 | Cache Friendly |
| BFS | \_Z6KernelP4NodePiPbS2\_S1\_S2\_i | 3 | 165.9271 | 112.0179 | -32.4897 | Cache Friendly |
| BFS | \_Z6KernelP4NodePiPbS2\_S1\_S2\_i | 4 | 76.2236 | 61.3361 | -19.5314 | Cache Friendly |
| BFS | \_Z6KernelP4NodePiPbS2\_S1\_S2\_i | 5 | 21.3021 | 36.1667 | 69.78 | Cache Unfriendly |
| BFS | \_Z6KernelP4NodePiPbS2\_S1\_S2\_i | 6 | 22.5533 | 44.4395 | 97.0421 | Cache Unfriendly |
| BFS | \_Z6KernelP4NodePiPbS2\_S1\_S2\_i | 7 | 46.5675 | 86.5094 | 85.7721 | Cache Unfriendly |
| BFS | \_Z6KernelP4NodePiPbS2\_S1\_S2\_i | 8 | 354.4445 | 455.3303 | 28.4631 | Cache Unfriendly |
| BFS | \_Z6KernelP4NodePiPbS2\_S1\_S2\_i | 9 | 473.1056 | 486.792 | 2.8929 | Cache Insensitive |

**Task 2 - Profiling-based Cache Bypassing**

Assumptions for Performance category

Formula used to calculate Percentage change of comparing the IPC with / without Profiling-based cache bypassing.

(IPC with cache bypassing – IPC with no cache bypassing) \* 100 / IPC with no cache bypassing

* less than 0% is Deterioration.
* More than 0% Improvement.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Benchmark name | kernel\_name | kernel\_  launch \_uid | IPC with no cache bypassing | IPC with profile bypassing | Percentage change | Performance  category |
| Rodinia | | | | | | |
| LUD | \_Z12lud\_internalPfii | 3 | 712.5299 | 721.2603 | 1.2253 | Improvement |
| LUD | \_Z13lud\_perimeterPfii | 5 | 13.6126 | 14.3418 | 5.3568 | Improvement |
| LUD | \_Z12lud\_internalPfii | 6 | 637.3949 | 642.5734 | 0.8124 | Improvement |
| LUD | \_Z13lud\_perimeterPfii | 8 | 12.6459 | 13.3236 | 5.359 | Improvement |
| LUD | \_Z12lud\_internalPfii | 9 | 556.1233 | 557.6649 | 0.2772 | Improvement |
| LUD | \_Z13lud\_perimeterPfii | 11 | 11.6784 | 12.3045 | 5.3612 | Improvement |
| LUD | \_Z12lud\_internalPfii | 12 | 502.3962 | 506.7778 | 0.8721 | Improvement |
| LUD | \_Z13lud\_perimeterPfii | 14 | 10.7269 | 11.3033 | 5.3734 | Improvement |
| LUD | \_Z12lud\_internalPfii | 15 | 423.2689 | 429.6447 | 1.5063 | Improvement |
| LUD | \_Z13lud\_perimeterPfii | 17 | 9.7561 | 10.2805 | 5.3751 | Improvement |
| LUD | \_Z12lud\_internalPfii | 18 | 352.6066 | 357.2629 | 1.3205 | Improvement |
| LUD | \_Z13lud\_perimeterPfii | 20 | 8.7844 | 9.2568 | 5.3777 | Improvement |
| LUD | \_Z12lud\_internalPfii | 21 | 290.0794 | 293.3001 | 1.1103 | Improvement |
| LUD | \_Z13lud\_perimeterPfii | 23 | 7.8118 | 8.2322 | 5.3816 | Improvement |
| LUD | \_Z12lud\_internalPfii | 24 | 232.6988 | 235.2133 | 1.0806 | Improvement |
| LUD | \_Z13lud\_perimeterPfii | 26 | 6.8493 | 7.2186 | 5.3918 | Improvement |
| LUD | \_Z12lud\_internalPfii | 27 | 178.1328 | 180.4473 | 1.2993 | Improvement |
| LUD | \_Z13lud\_perimeterPfii | 29 | 5.8735 | 6.1903 | 5.3937 | Improvement |
| LUD | \_Z12lud\_internalPfii | 30 | 131.4149 | 132.7995 | 1.0536 | Improvement |
| LUD | \_Z13lud\_perimeterPfii | 32 | 4.8967 | 5.161 | 5.3975 | Improvement |
| LUD | \_Z12lud\_internalPfii | 33 | 91.527 | 92.7536 | 1.3402 | Improvement |
| LUD | \_Z13lud\_perimeterPfii | 35 | 3.9191 | 4.1308 | 5.4018 | Improvement |
| LUD | \_Z12lud\_internalPfii | 36 | 58.4963 | 59.3623 | 1.4804 | Improvement |
| LUD | \_Z13lud\_perimeterPfii | 38 | 2.9442 | 3.1034 | 5.4072 | Improvement |
| LUD | \_Z12lud\_internalPfii | 39 | 33.1178 | 33.585 | 1.4107 | Improvement |
| LUD | \_Z13lud\_perimeterPfii | 41 | 1.966 | 2.0726 | 5.4222 | Improvement |
| LUD | \_Z12lud\_internalPfii | 42 | 14.7418 | 14.943 | 1.3648 | Improvement |
| ISPASS | | | | | | |
| LPS | \_Z13GPU\_laplace3diiiiPfS\_ | 1 | 638.116 | 667.4357 | 4.5947 | Improvement |
| BFS | \_Z6KernelP4NodePiPbS2\_S1\_S2\_i | 5 | 87.2392 | 66.722 | -23.5183 | Deterioration |
| BFS | \_Z6KernelP4NodePiPbS2\_S1\_S2\_i | 6 | 86.6631 | 66.8945 | -22.8109 | Deterioration |
| BFS | \_Z6KernelP4NodePiPbS2\_S1\_S2\_i | 7 | 145.4857 | 111.03 | -23.6832 | Deterioration |
| BFS | \_Z6KernelP4NodePiPbS2\_S1\_S2\_i | 8 | 229.1067 | 175.9334 | -23.209 | Deterioration |