|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Application | Dijkstra | Qsort | Stringsearch | Gsm-untoast | Jpeg-cjpeg |
| Instruction Count | 54881769 | 41899040 | 300884 | 11704498 | 27260761 |
| Execution Time in cycles | 478919292 | 627896865 | 5256574 | 39186017 | 160568219 |
| CPIBase | 8.7264 | 14.9859 | 17.4704 | 3.3479 | 5.8901 |
| MPI I-L1 | 1571582 | 2496081 | 28776 | 93075 | 401224 |
| MPI D-L1 | 585553 | 1595745 | 1022 | 8715 | 290224 |
| CPI0 | 1.8985 | 2.0741 | 2.1571 | 1.8894 | 1.9058 |
| SPIdeal | 4.59647 | 7.2253 | 8.09902 | 1.77194 | 3.09062 |

Task 1

Task 2

APP1 - Stringsearch

APP2 - Qsort

2.1 Optimize D-cache

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 4KB | | | 8KB | | | 16KB | | | 32KB | | |
| CPI | MPI | SP | CPI | MPI | SP | CPI | MPI | SP | CPI | MPI | SP |
| APP1 | 17.4704 | 1022 | 1 | 17.3906 | 751 | 1.00447 | 17.3766 | 599 | 1.0053 | 17.3695 | 564 | 1.00581 |
| APP2 | 14.9859 | 1595745 | 1 | 14.6334 | 1416833 | 1.0241 | 14.3155 | 1253511 | 1.04683 | 14.0096 | 1095184 | 1.06969 |

2.1.1. Cache size

Optimum size = 32 kB

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 way | | | 2 way | | | 4 way | | | 8 way | | |
| CPI | MPI | SP | CPI | MPI | SP | CPI | MPI | SP | CPI | MPI | SP |
| APP1 | 17.3695 | 566 | 1.00581 | 17.3695 | 564 | 1.00581 | 17.3695 | 564 | 1.00581 | 17.3695 | 564 | 1.00581 |
| APP2 | 14.1661 | 1176648 | 1.0579 | 14.0096 | 1095184 | 1.06969 | 14.0330 | 1110668 | 1.0679 | 14.0768 | 1129671 | 1.0646 |

2.1.2 Associativity

Optimum associativity = 2 way

2.1.3. Block size

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 16 B | | | 32 B | | | 64 B | | | 128 B | | |
| CPI | MPI | SP | CPI | MPI | SP | CPI | MPI | SP | CPI | MPI | SP |
| APP1 | 17.4170 | 1101 | 1.0031 | 17.3695 | 564 | 1.00581 | 17.3465 | 292 | 1.00714 | 17.3380 | 155 | 1.00764 |
| APP2 | 16.5296 | 2166716 | 0.90661 | 14.0096 | 1095184 | 1.0697 | 13.0687 | 560021 | 1.1467 | 12.4517 | 293371 | 1.2035 |

Optimum block size = 128 B

2.2. Optimize I-cache

2.2.1. Cache size

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 4KB | | | 8KB | | | 16KB | | | 32KB | | |
| CPI | MPI | SP | CPI | MPI | SP | CPI | MPI | SP | CPI | MPI | SP |
| APP1 | 17.4704 | 28776 | 1 | 10.5235 | 15222 | 1.6601 | 4.6121 | 3910 | 3.7879 | 3.2481 | 1557 | 5.3787 |
| APP2 | 14.9859 | 2496081 | 1 | 11.7390 | 1660791 | 1.2761 | 6.3336 | 121103 | 2.3661 | 5.8144 | 948 | 2.5774 |

Optimum size – 32 kB

2.2.2 Associativity

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 way | | | 2 way | | | 4 way | | | 8 way | | |
| CPI | MPI | SP | CPI | MPI | SP | CPI | MPI | SP | CPI | MPI | SP |
| APP1 | 3.6848 | 2407 | 4.7412 | 3.2481 | 1557 | 5.3602 | 2.7094 | 644 | 6.4259 | 2.7094 | 644 | 6.4259 |
| APP2 | 6.0049 | 61146 | 2.4956 | 5.8144 | 948 | 2.57738 | 5.8142 | 907 | 2.5775 | 5.8142 | 902 | 2.5775 |

Optimum associativity = 4 way

2.2.3. Block size

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 16 B | | | 32 B | | | 64 B | | | 128 B | | |
| CPI | MPI | SP | CPI | MPI | SP | CPI | MPI | SP | CPI | MPI | SP |
| APP1 | 2.9945 | 1219 | 5.8342 | 2.7094 | 644 | 6.4481 | 2,5595 | 351 | 6.8257 | 2.4821 | 195 | 7.0386 |
| APP2 | 5.8169 | 1688 | 2.5716 | 5.8142 | 907 | 2.5728 | 5.8128 | 501 | 2.5734 | 5.8121 | 276 | 2.5738 |

Optimum block size = 128 B

2.3

|  |  |  |  |
| --- | --- | --- | --- |
|  | Cache size | Associativity | Block size |
| D-cache | 32 kB | 2 ways | 128 |
| I-cache | 32 kB | 4 ways | 128 |

Optimum configuration

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Application | Dijkstra | Qsort | Stringsearch | Gsm-untoast | Jpeg-cjpeg | Geometric Mean |
| CPI0 | 1.8985 | 2.0741 | 2.1571 | 1.8894 | 1.9058 |  |
| CPIBase | 8.7264 | 14.9859 | 17.4704 | 3.3479 | 5.8901 |  |
| CPI | 1.9922 | 2.7604 | 2.2877 | 1.9002 | 2.0293 |  |
| SPOPT1 | 4.3803 | 5.42889 | 7.63666 | 1.7619 | 2.9025 |  |
| SPIdeal | 4.59647 | 7.2253 | 8.09902 | 1.77194 | 3.09062 |  |

Task 3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Application | Dijkstra | Qsort | Stringsearch | Gsm-untoast | Jpeg-cjpeg | Geometric Mean |
| CPIBase | 8.7264 | 14.9859 | 17.4704 | 3.3479 | 5.8901 |  |
| CPIOPT2 | 2.3459 | 2.8042 | 2.4298 | 1.9179 | 2.2102 |  |
| SPOPT1 | 4.3803 | 5.42889 | 6.3253 | 1.7619 | 2.9025 |  |
| SPOPT2 | 3.7199 | 5.34409 | 5.9554 | 1.7456 | 2.6649 |  |
| SPIdeal | 4.59647 | 7.2253 | 8.09902 | 1.77194 | 3.09062 |  |