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| Implementation | Real time | Description Optimization |
| C | 10.751 | C Implementation |
| Assembly Unoptimized | 10.803 | Assembly implementation unoptimized |
| Assembly Optimized 1 | 10.731 | Quicksort sum: move stack variables into register before using instead of moving stack variables direct |
| Assembly Optimized 2 | 10.338 | Quicksort sum: In one time, manually allocate stack space subtracting %rsp to avoid the system allocate automatically in each function call |
| Assembly Optimized 3 | 10.264 | Quicksort sum: Move all initialization inside the if statement |
| Assembly Optimized 4 | 10.107 | All: replace all imulq with salq when calculating array location |
| Assembly Optimized 5 | 10.036 | All: delete some duplicated movq to try to use registers more and replace r8 and r9 with rdi and rsi |
| Assembly Optimized 6 | 9.998 | Afterw: rearranging the code sequence to avoid stall(subq and addq) |
| Assembly Optimized 7 | 8.954 | All: use r8 register to replace I which was previously  -32(%rbp) |
| Assembly Optimized 8 | 8.896 | Afterw: Use r10 as temp instead use temp as local variable |
| Assembly Optimized 9 | 8.803 | Whilei: use rdx directly to reduce address accsessing |
| Assembly Optimized 10 | 8.687 | Make helper function for swapping and adjust the stack space allocated due to previous change |