Quicksost fr. Quick Sort (4,2) // Sosts a[p], ..., a[q] which one in an array a[o... n-I]> 1 a In is considered to exist and of all elements in a Ta. n-I. 4 (p22) then 1= Postition (a, p, 2+D); Quick Sort (P, 4-1); Quick Satt (144,2); fu Partition (a, m, p) If Reassange The elemente in such a way That The contents 1 of a tris one shifted alongwith others may to being all Nedament les tran it hyfore itself and all trasse after. Strictly speaking, if initially t= a [m], then after completion 1 a 19 = t for some q dutien monet-1, a tik] st for 11msk22andaIkJ7tforq<kCp. 11 fn rétuens 2. ゆニの「か」; ごっか; る三か; - sepert supreat i=i+1 until (aTi) 712) report J=J-1 until (a [J] < ve); Tim intrebasse (a Ti), a Til a[w] = a[i]; a[i] = b

Amerlysės: Let C(n) he the element emporisons in QueckSost. We asseme that the n relevant to be sorted asse distinct and the input districe such that the postition almost v=atmin the call to Postition (a, m, p) has an equal probability of hing the its smallest element, 15 isp_min The number of element comparisons in each call of Postilian is at most p-m+1. dot s be the total number of elements in all The calls to Postation at any level of seconsion. At break one only one eally Postition (a, a, n) is made and 2=n-1; at had two at most two calls are made and 2= n-2 and so on. At lach lavel of secussion, O(2) element comparisons or made by Poetition At cook level, or is at least one less tran the 2 at The purious level as the partitioning about of the previous and are deninated. Hence, the work-case emparisons, Cu(n) = 52 = 0 (n2). The average case CA(N) of C(n) is much less than Gu(n). Under the assumption made, the postilizing elevent whose on equal probability of heing the ith-smallet element, 1 < i < p-m, in a [m. p-]. Hence the two subassays semaining to he sosted are a [m:i] and a [i+1:p-] with probability /(pm), m S/Cp. thom the we obtain the secussance Ilalian

The number of element composisons sequend by Postition on its first call 12 n. note that Cp(0)=Cp(D)=0. Hultiplycap broth sides by n, n Ch(n) = n (n+1) +2 [Ch(o)+(h(1)+...+ Ch(n)] Replacing n by n-1 (n-1) CA(n-1) = n (n-1) +2 [CA(0)+···+ CA(n-2)] Subtracting Wils from the last egn, we get nG(n)-(n-1)PA(n-1)=2n+2PA(n-1) $\frac{C_{A}(n)}{-} = \frac{C_{A}(n-1)}{-}$ Repeatedly using this egn. to substitute for CA(n-D, CA(n-2),... 35K5n+1

we get CA(n) 52(n+1) [log(n+2) - log2) = O(n log n). Rondonized Quiex sort Instead of picking up a [m] as the proof we propose to choose, satur preh a sandom element as the pastilion dement or pivot. The sesultant sandomizal algorithm: fr. Rquersort (p, 2) } 1/ Sosto The almost a [p],.., a [9] which are in assay IX a [o. n-I], a [n] is considued to be defined and 7 de demante 1) ma [o.. n-1). (p22) Then? interchange (a, Random() mod(2-p+1)+p, p); d= Postition(a, p, 2+1); RamekSext (p, j-D); RquerSost (1+1, 2); This is a Los hegos algorithm since it will always output the correct angues.

Enoy cell to the sandomizer Rendom takes a collision amount of thee. If there are only a few demonts to sent, the taken by the sandomize may be comparable to the scot of the computation. That is very me induce the sandomizer only y (2-p)>s, of course, solver comparable. Although the average time of Requests out on any input of n elements. The supersence solver for A(n) (0 A(n) = \frac{1}{2} \left(A(n) + A(n-k)) + n + 1. ISK \(\) While be fare, A(n) = O(n log n).	
If there are only a few demont to sort, the time taken by the sandonizer may be composable to the sort of the computation. That is why, we involve the sandonizer only if (9-D>S, of cause, Scholern empirically. All he the average time of RemarkSort on any inport of n elements. The secusioners scholar for A(n) is A(n) = \frac{1}{2} \left(A(n-1) + A(n-1) + n + 1.	
If there are only a few demont to sort, the time taken by the sandonized may be comparable to the sort of the compatation. That is why, we himshe the sandonizer only if (2-D)>S, of cause, Solver amprishedly. Let Alm be the average time of Rejewant Sort on any infact of N elements. The secusioner scholar for A(n) is A(n) = \frac{1}{2} \sum (A(n-1) + A(n-1) + n + 1.	
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$A(n) = \frac{1}{n} \sum (A(n-1) + A(n-1)) + n + 1$ dike before	
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