

- 1 Give an example of application that requires algorithmic content at the application level? and discuss the function of the algorithms involved

Robot vacuum cleaner: create floor map, cover whole map, bypass obstacles.

- 2 Suppose we are comparing implementations of insertion sort and merge sort on the same machine. For inputs of size n ? insertion sort runs in $8 * n^2$ steps, while merge sort runs in $64 * n * \ln(n)$ steps. For which value of n does insertion sort beat merge sort?

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- 3 What is the smallest value of n such that an algorithm whose running time is $100 * n^2$ runs faster than an algorithm whose running time is 2^2 on the same machine?

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- 4 For each function $f(n)$ and time t in the following table, determine the largest size n of a problem that can be solved in time t , assuming that the algorithm to solve the problem takes $f(n)$ microseconds

	1 second	1 minute	1 hour	1 day	1 month	1 year	1 century
$lg(n)$	$2^{(10^6)}$	$2^{(6 * 10^7)}$	$2^{(36 * 10^8)}$	$2^{(824 * 10^8)}$	$2^{(2 * 10^{12})}$	$2^{(3 * 10^{13})}$	$2^{(3 * 10^{15})}$
$sqrt(n)$	1.00e+12	3.60e+15	1.30e+19	7.46e+21	6.72e+24	9.95e+26	9.95e+30
n	1.00e+6	6.00e+7	3.60e+9	8.64e+10	2.59e+12	3.15e+13	3.15e+15
$n * lg(n)$	6.27e+4	2.80e+6	1.33e+8	2.76e+9	7.19e+10	1.00e+11	1.00e+11
n^2	1.00e+3	7.74e+3	6.00e+4	2.94e+5	1.61e+6	5.62e+6	5.62e+7
n^3	9.90e+1	3.91e+2	1.53e+3	4.42e+3	1.37e+4	3.16e+4	1.47e+5
2^n	1.90e+1	2.50e+1	3.10e+1	3.60e+1	4.10e+1	4.40e+1	5.10e+1
$n!$	9	11	12	13	15	16	17