Chapter 5

Algorithm Analysis

Data Structures & Problem Solving
Using JAVA
Second Edition

Mark Allen Weiss

Figure 5.1
Running times for small inputs

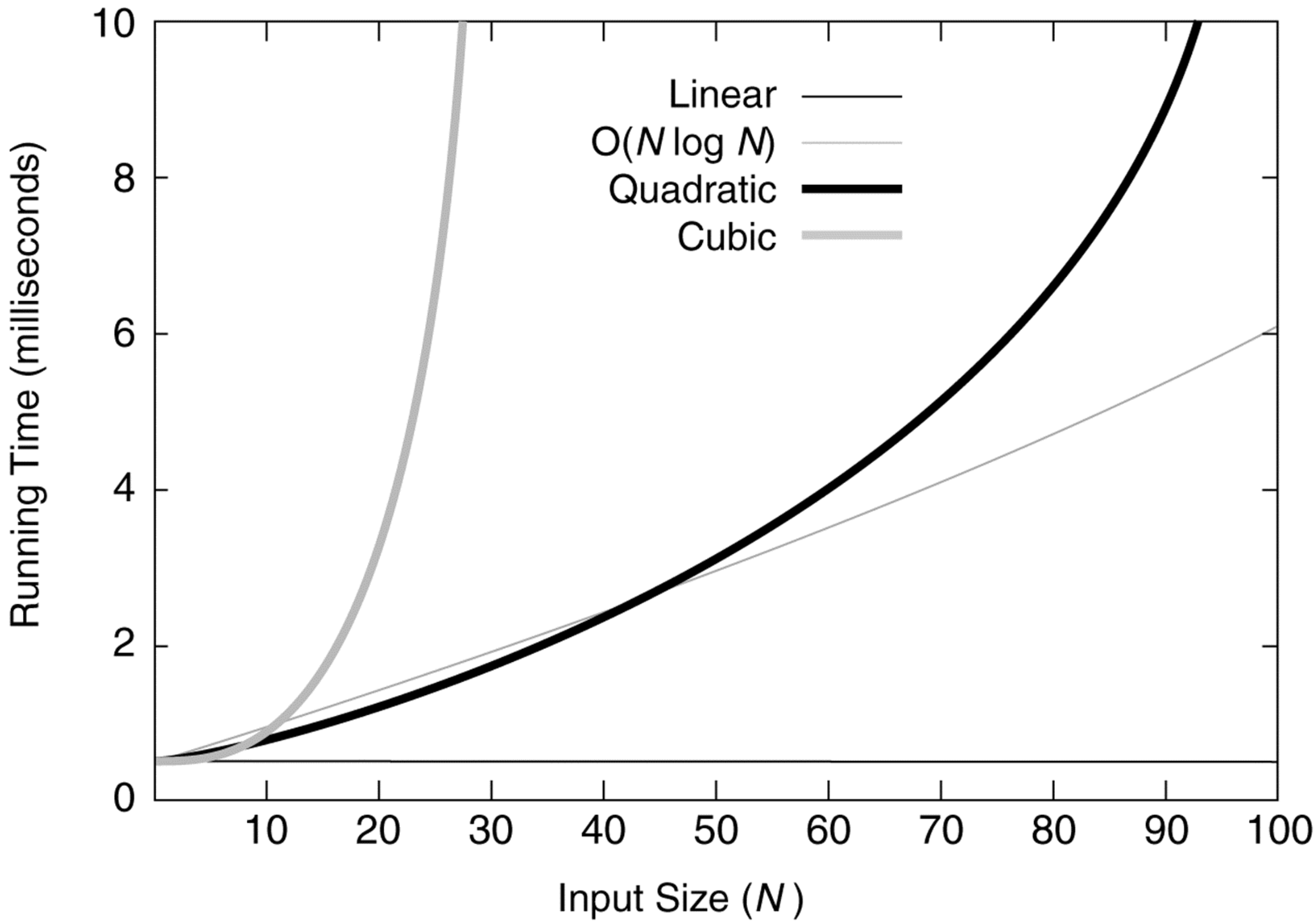

Figure 5.2

Running times for moderate inputs

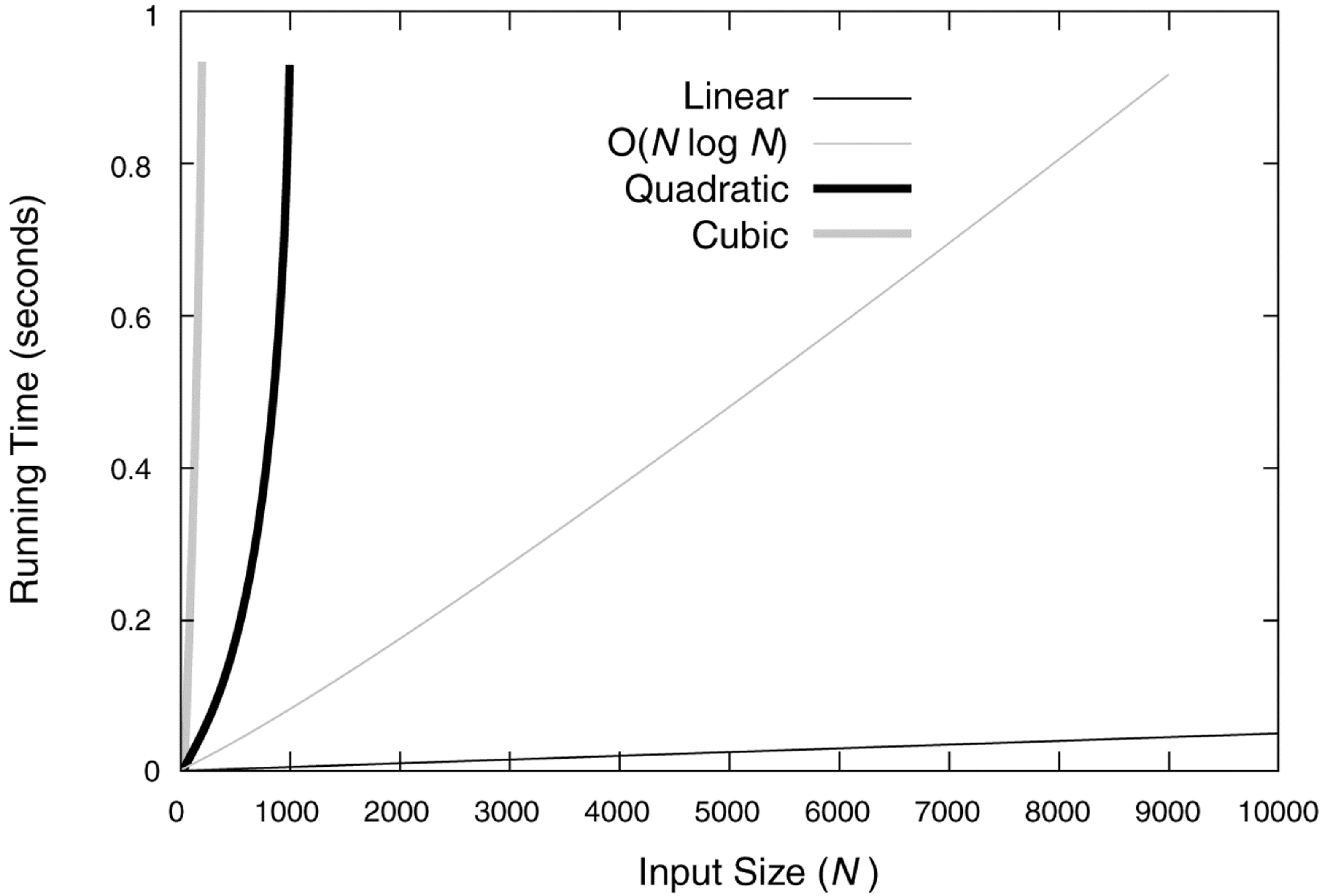

Figure 5.3

Functions in order of increasing growth rate

FUNCTION	NAME
c	Constant
$\log N$	Logarithmic
$\log^2 N$	Log-squared
N	Linear
$N \log N$	$N \log N$
N^2	Quadratic
N^3	Cubic
2^N	Exponential

Figure 5.6
The subsequences used in Theorem 5.2

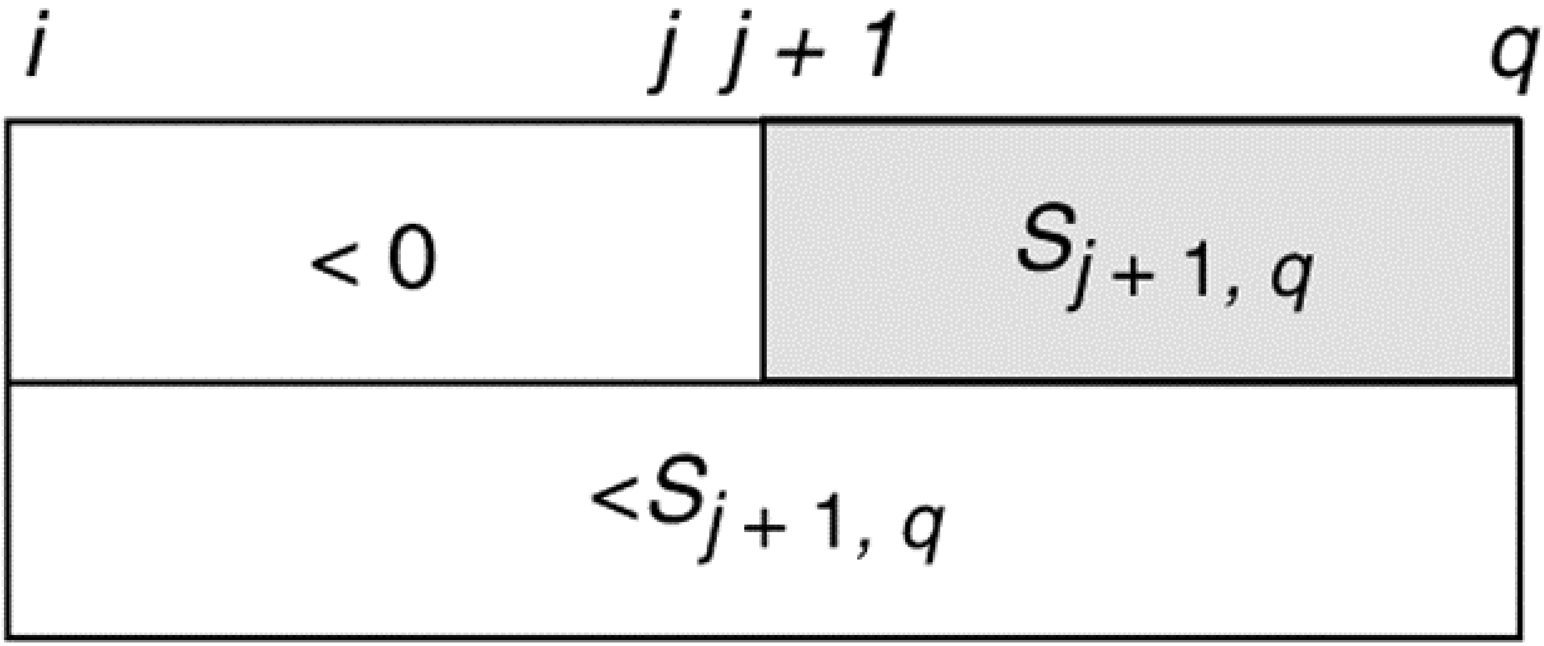

Figure 5.7

The subsequences used in Theorem 5.3. The sequence from p to q has a sum that is, at most, that of the subsequence from i to q. On the left-hand side, the sequence from i to q is itself not the maximum (by Theorem 5.2). On the right-hand side, the sequence from i to q has already been seen.

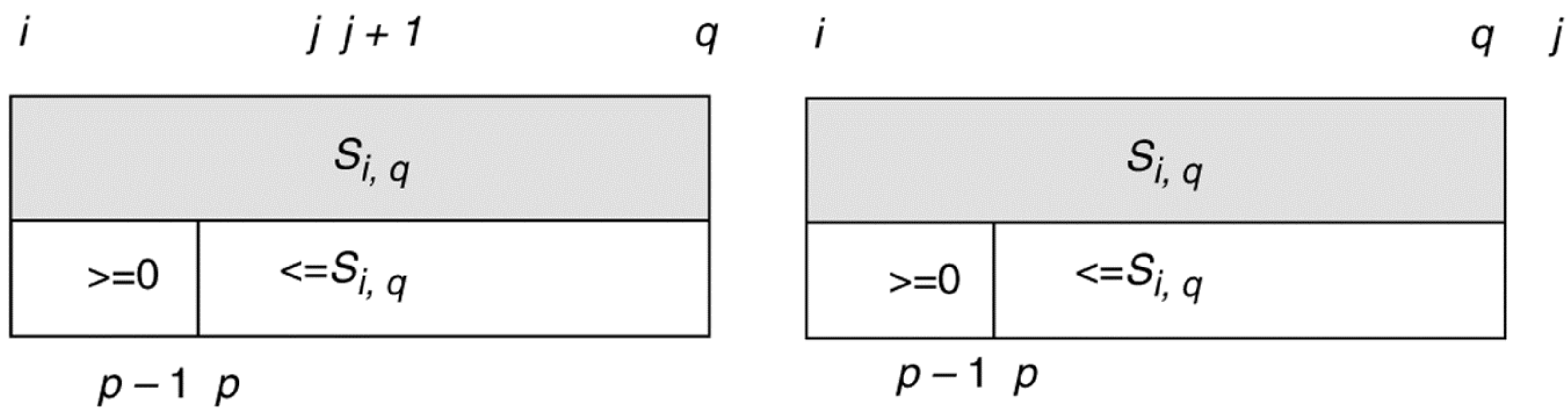

Figure 5.9

Meanings of the various growth functions

MATHEMATICAL EXPRESSION	RELATIVE RATES OF GROWTH
$T(N) = O(F(N))$	Growth of $T(N)$ is $\leq$ growth of $F(N)$.
$T(N) = \Omega(F(N))$	Growth of $T(N)$ is $\geq$ growth of $F(N)$.
$T(N) = \Theta(F(N))$	Growth of $T(N)$ is $=$ growth of $F(N)$.
$T(N) = o(F(N))$	Growth of $T(N)$ is $<$ growth of $F(N)$.

Figure 5.10

Observed running times (in seconds) for various maximum contiguous subsequence sum algorithms

	Figure 5.4	Figure 5.5	Figure 7.20	Figure 5.8
N	$O(N^3)$	$O(N^2)$	$O(N \log N)$	$O(N)$
10	0.000009	0.000004	0.000006	0.000003
100	0.002580	0.000109	0.000045	0.000006
1,000	2.281013	0.010203	0.000485	0.000031
10,000	NA	1.2329	0.005712	0.000317
100,000	NA	135	0.064618	0.003206

Figure 5.13

Empirical running time for N binary searches in an N-item array

N	CPU Time T (milliseconds)	T/N	T/N^2	$T/(N \log N)$
10,000	100	0.01000000	0.00000100	0.00075257
20,000	200	0.01000000	0.00000050	0.00069990
40,000	440	0.01100000	0.00000027	0.00071953
80,000	930	0.01162500	0.00000015	0.00071373
160,000	1,960	0.01225000	0.00000008	0.00070860
320,000	4,170	0.01303125	0.00000004	0.00071257
640,000	8,770	0.01370313	0.00000002	0.00071046

