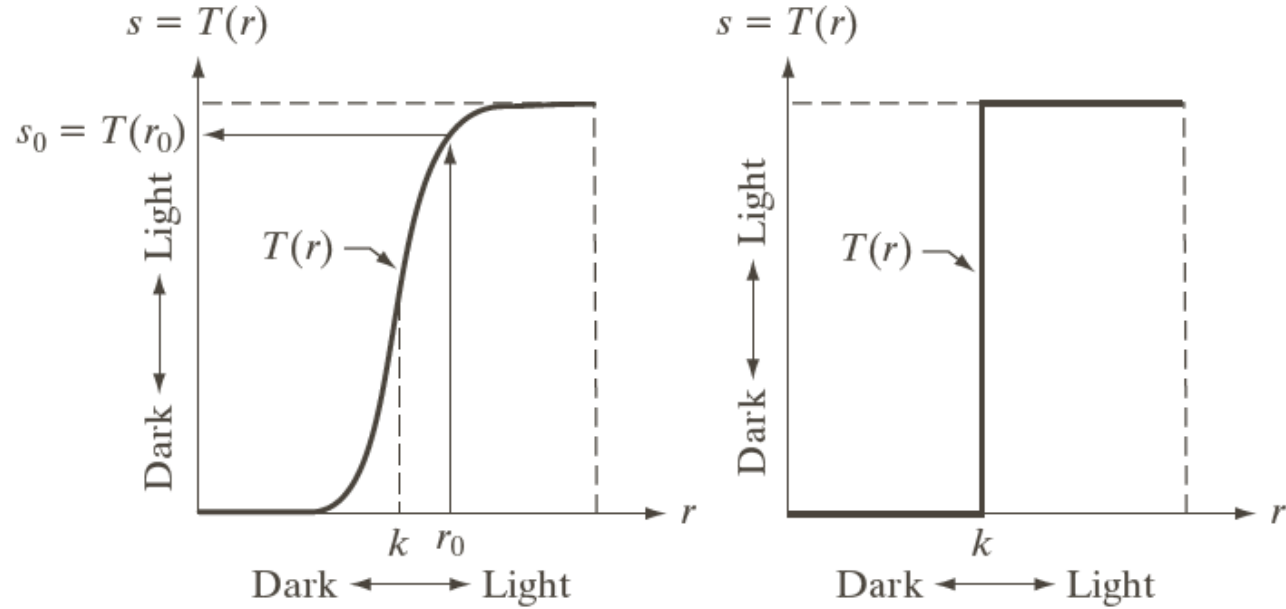


AREL ÜNİVERSİTESİ BİYOMEDİKAL GÖRÜNTÜ İŞLEME

UZAYSAL İŞLEMLER

DR. GÖRKEM SERBES

Yoğunluk İşlemleri



a b

FIGURE 3.2
Intensity transformation functions.
(a) Contrast-stretching function.
(b) Thresholding function.

Yoğunluk İşlemleri

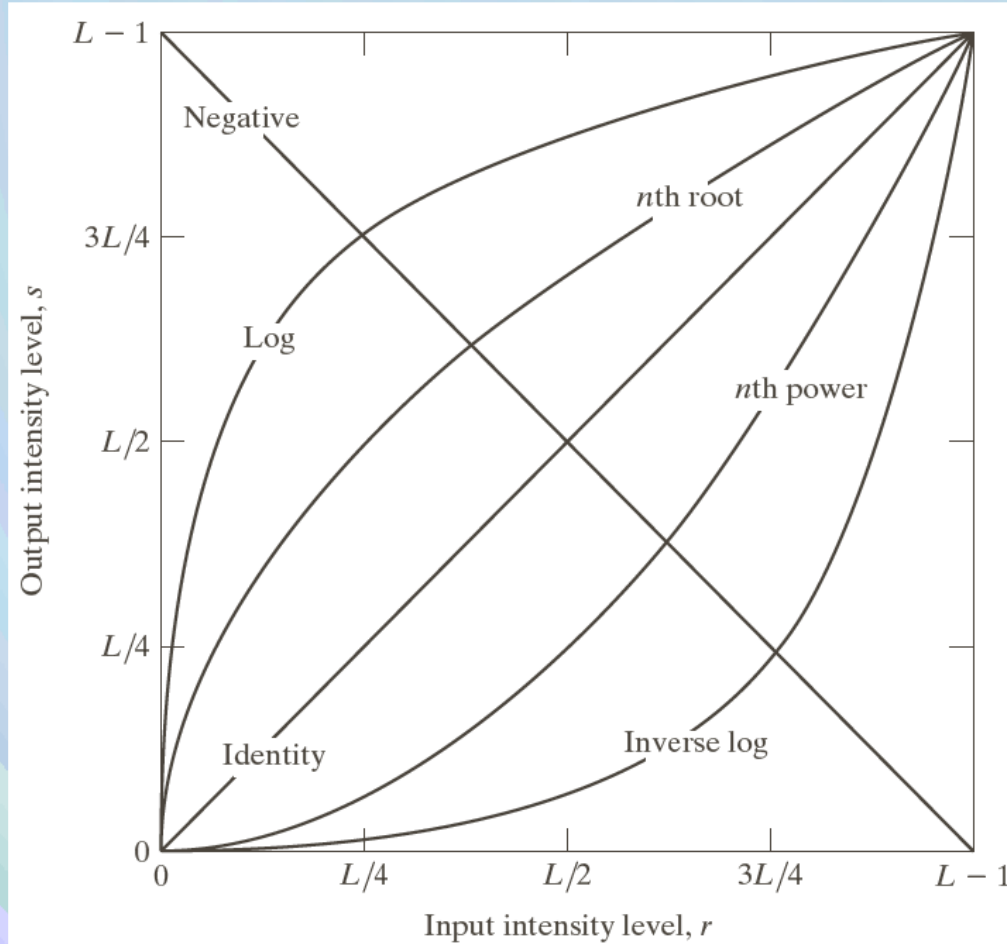
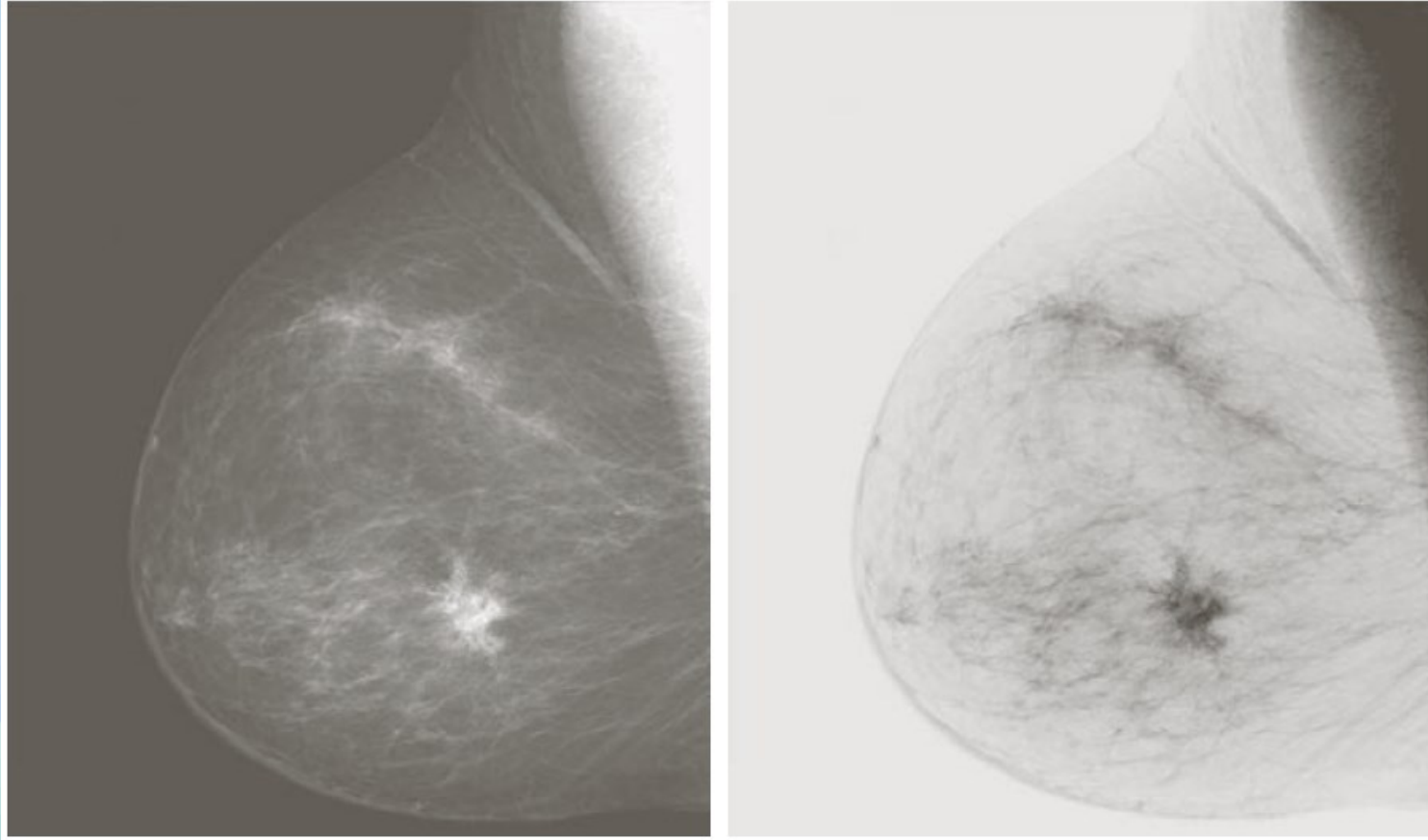


FIGURE 3.3 Some basic intensity transformation functions. All curves were scaled to fit in the range shown.

Yoğunluk İşlemleri



a b

FIGURE 3.4

(a) Original digital mammogram.

(b) Negative image obtained using the negative transformation in Eq. (3.2-1).

(Courtesy of G.E. Medical Systems.)

Gama Dönüşümü

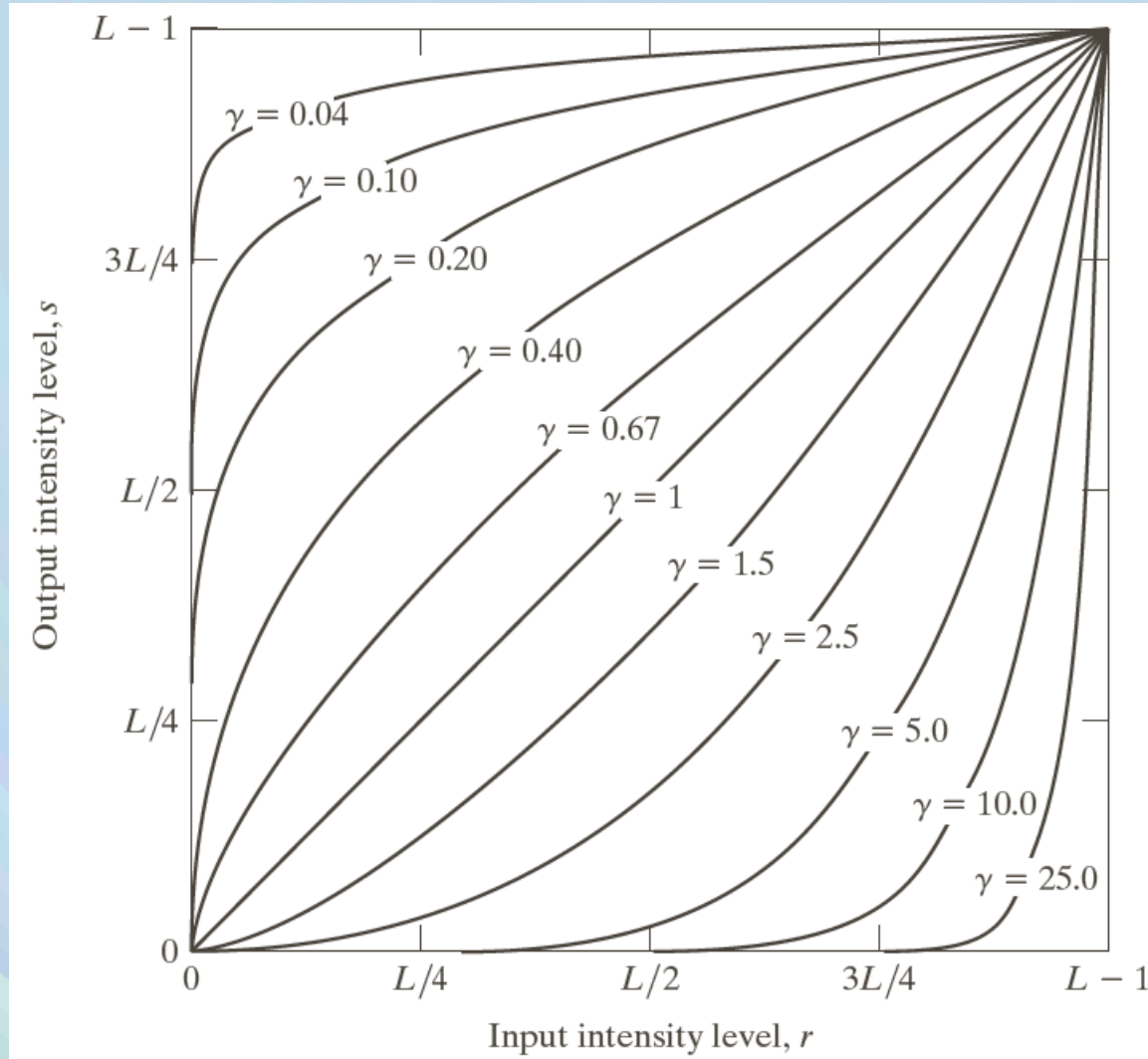
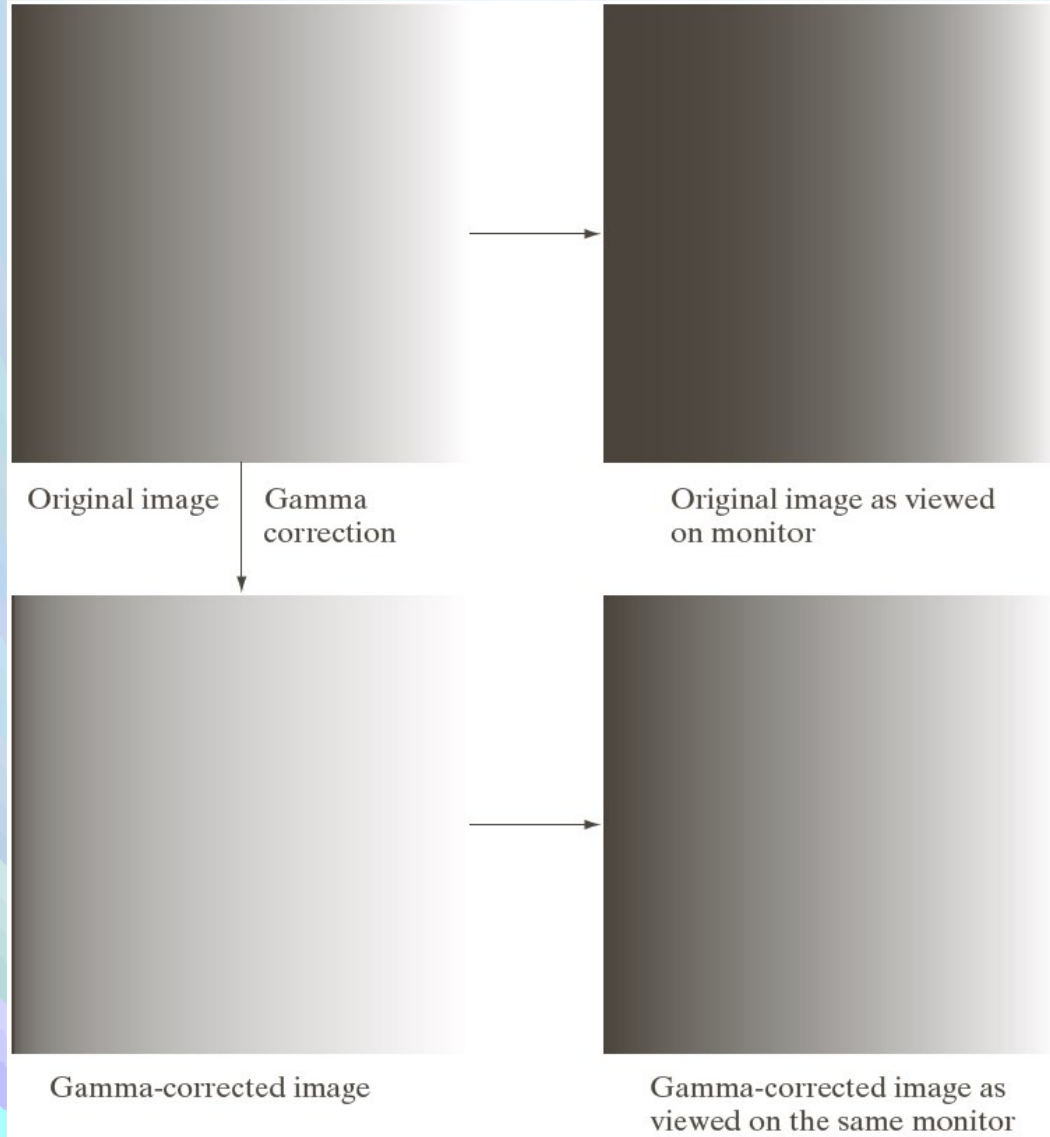


FIGURE 3.6 Plots of the equation $s = cr^\gamma$ for various values of γ ($c = 1$ in all cases). All curves were scaled to fit in the range shown.

Gama Dönüşümü

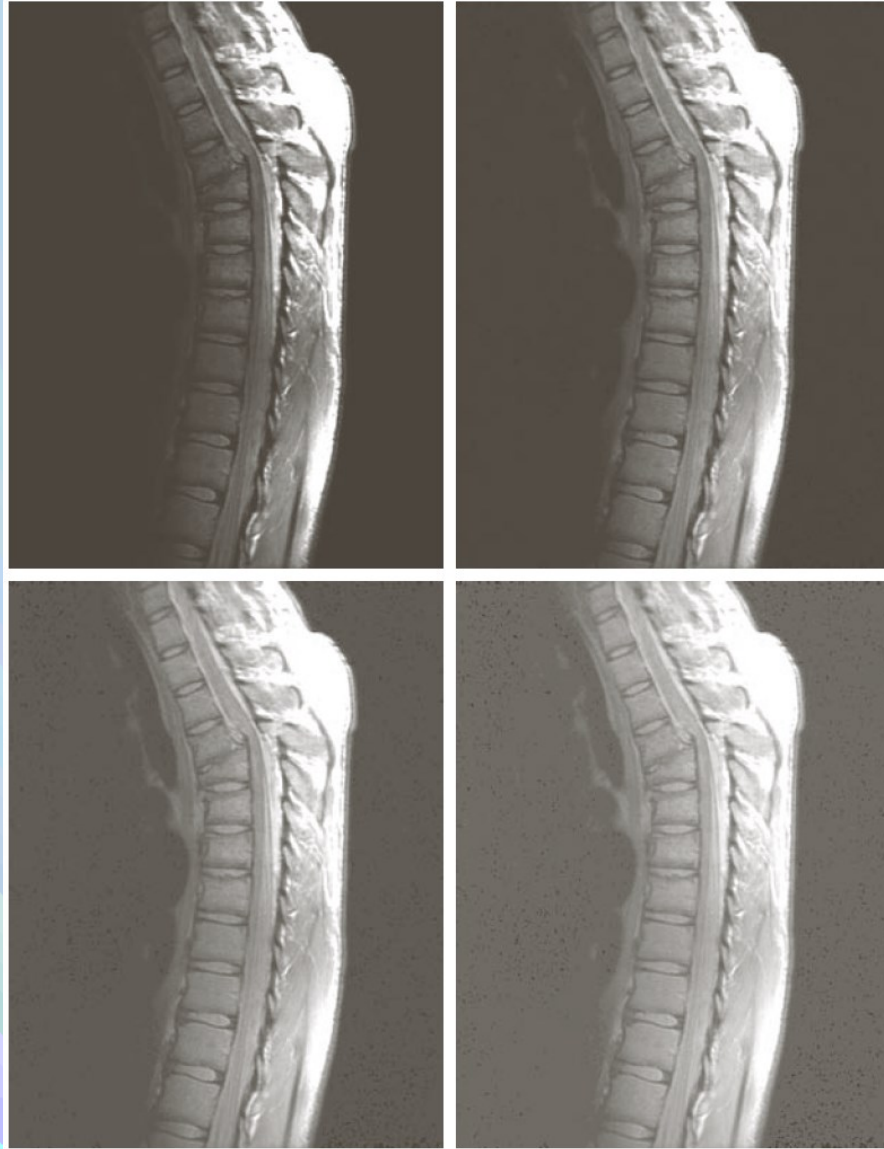


a	b
c	d

FIGURE 3.7

(a) Intensity ramp image. (b) Image as viewed on a simulated monitor with a gamma of 2.5. (c) Gamma-corrected image. (d) Corrected image as viewed on the same monitor. Compare (d) and (a).

Gama Dönüşümü



a	b
c	d

FIGURE 3.8

(a) Magnetic resonance image (MRI) of a fractured human spine.

(b)–(d) Results of applying the transformation in Eq. (3.2-3) with $c = 1$ and

$\gamma = 0.6, 0.4$, and 0.3 , respectively.

(Original image courtesy of Dr. David R. Pickens, Department of Radiology and Radiological Sciences, Vanderbilt University Medical Center.)

Gama Dönüşümü

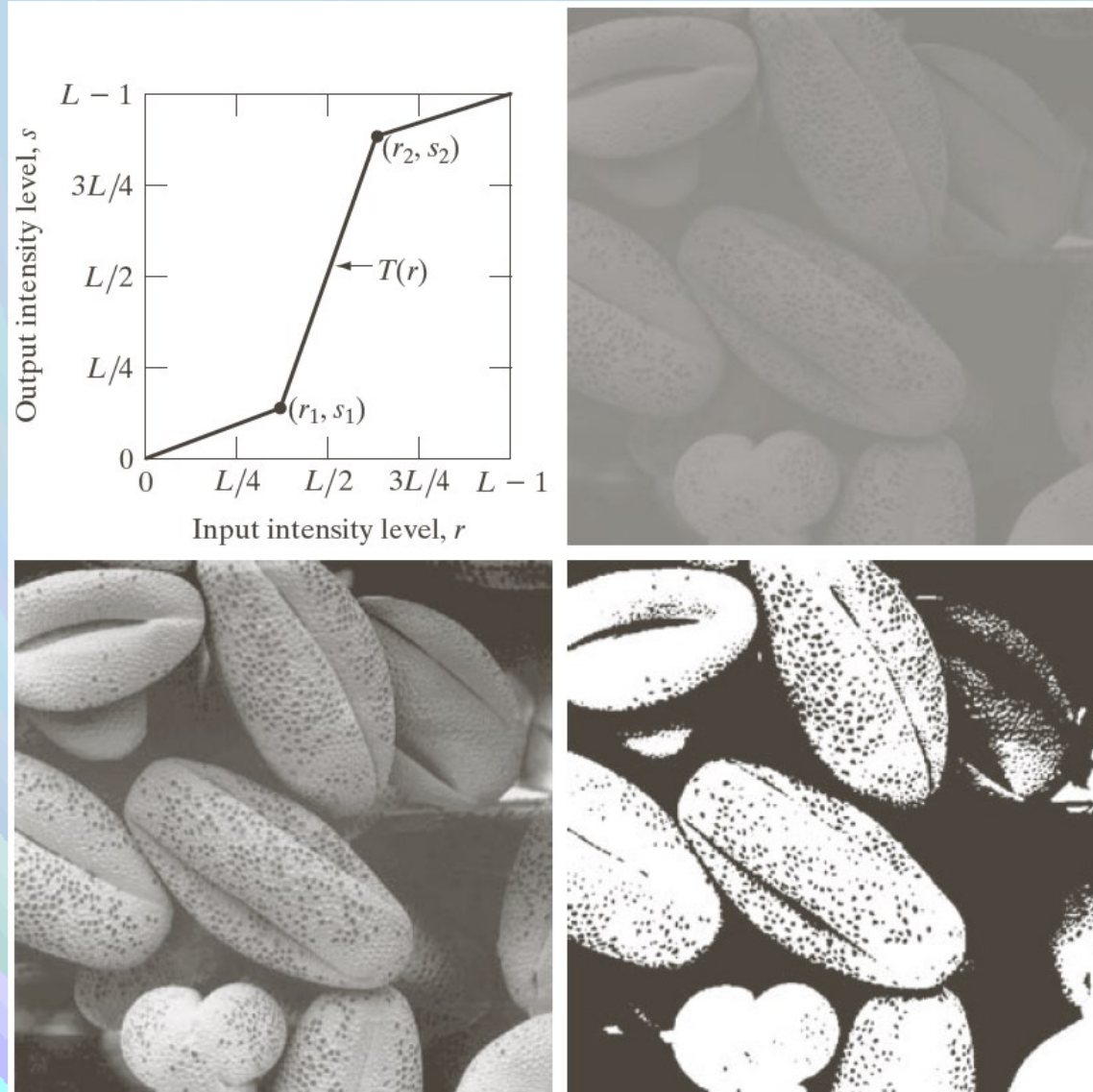


a	b
c	d

FIGURE 3.9

(a) Aerial image.
(b)–(d) Results of applying the transformation in Eq. (3.2-3) with $c = 1$ and $\gamma = 3.0, 4.0,$ and 5.0 , respectively. (Original image for this example courtesy of NASA.)

Parçalı Doğrusal Dönüşümler

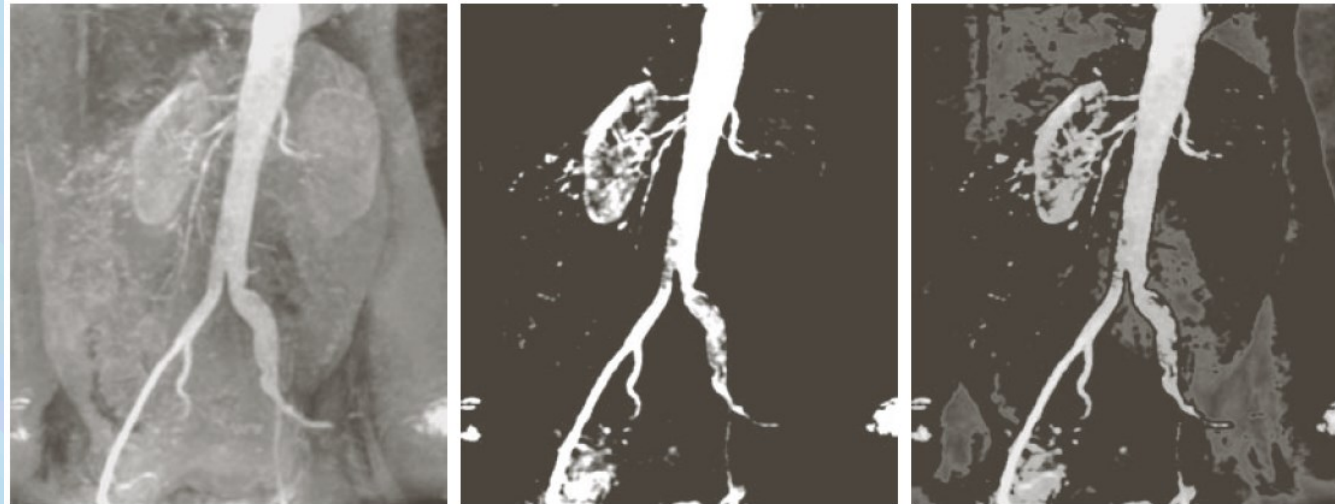
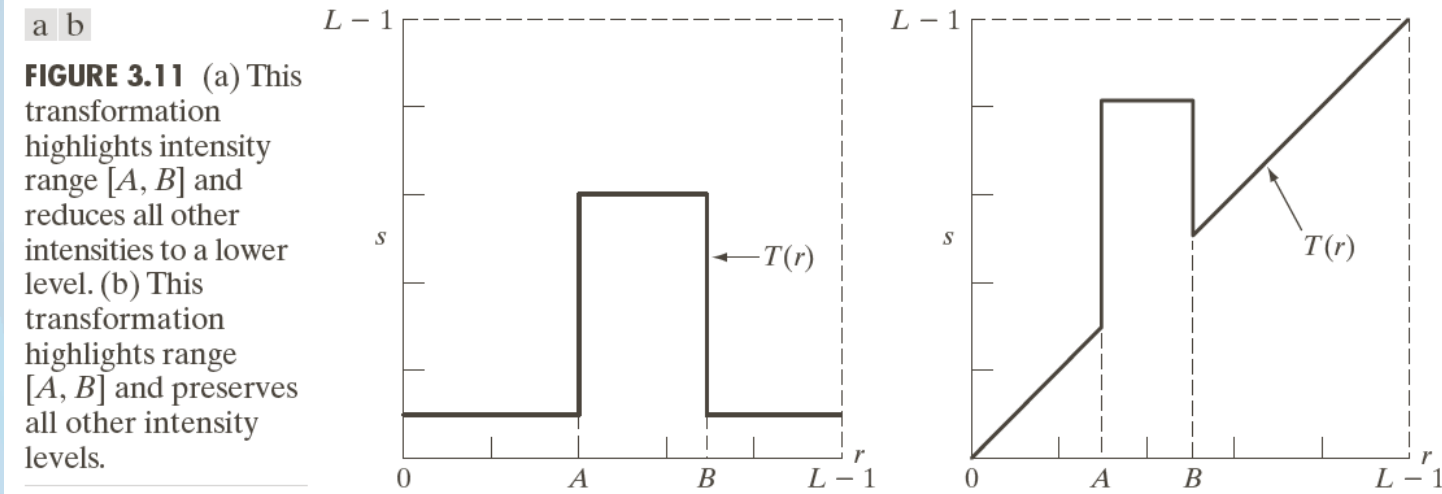


a	b
c	d

FIGURE 3.10

Contrast stretching.
(a) Form of transformation function. (b) A low-contrast image. (c) Result of contrast stretching. (d) Result of thresholding. (Original image courtesy of Dr. Roger Heady, Research School of Biological Sciences, Australian National University, Canberra, Australia.)

Parçalı Doğrusal Dönüşümler



a b c

FIGURE 3.12 (a) Aortic angiogram. (b) Result of using a slicing transformation of the type illustrated in Fig. 3.11(a), with the range of intensities of interest selected in the upper end of the gray scale. (c) Result of using the transformation in Fig. 3.11(b), with the selected area set to black, so that grays in the area of the blood vessels and kidneys were preserved. (Original image courtesy of Dr. Thomas R. Gest, University of Michigan Medical School.)

Histogram

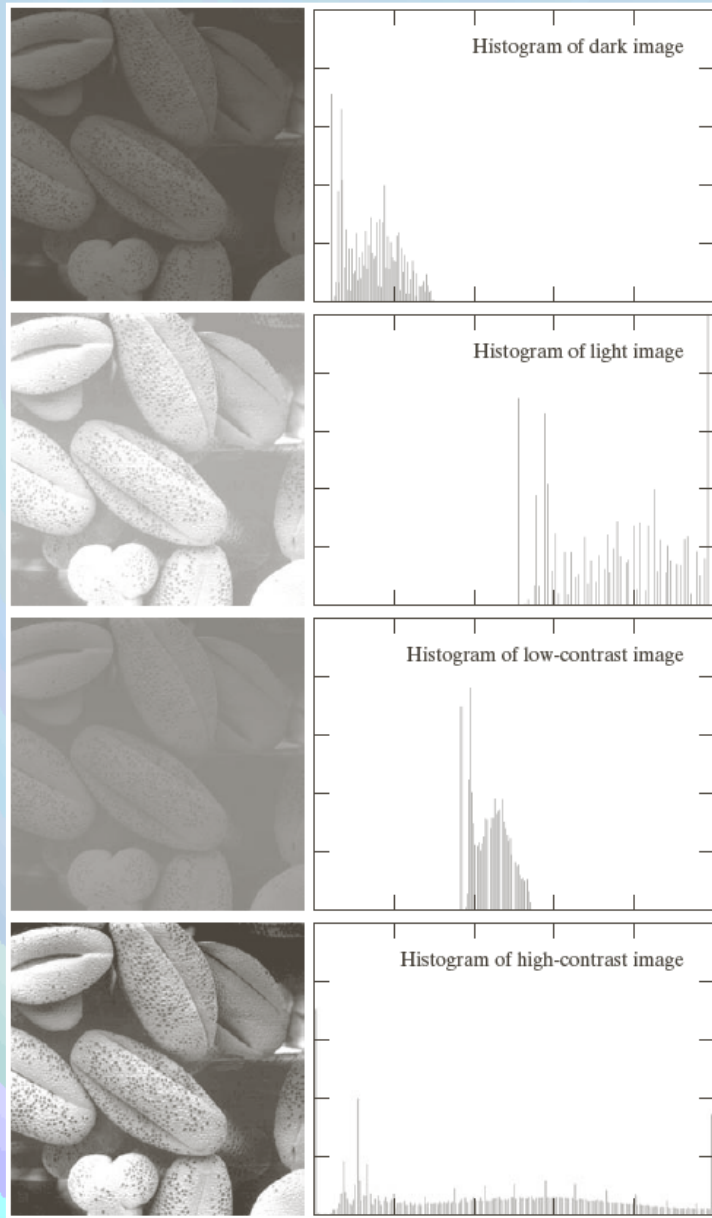
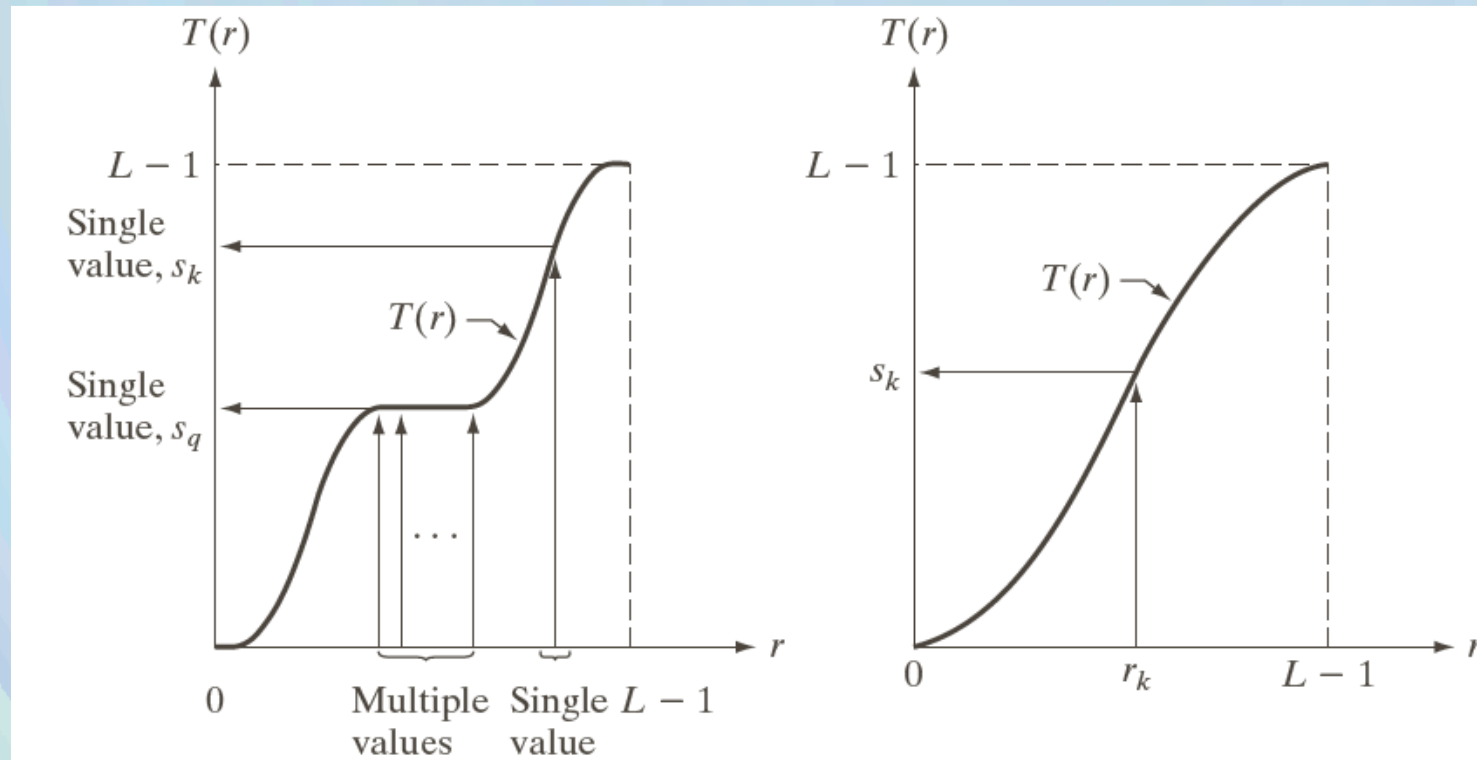


FIGURE 3.16 Four basic image types: dark, light, low contrast, high contrast, and their corresponding histograms.

Histogram Eşitleme



a b

FIGURE 3.17

(a) Monotonically increasing function, showing how multiple values can map to a single value. (b) Strictly monotonically increasing function. This is a one-to-one mapping, both ways.

Histogram Eşitleme

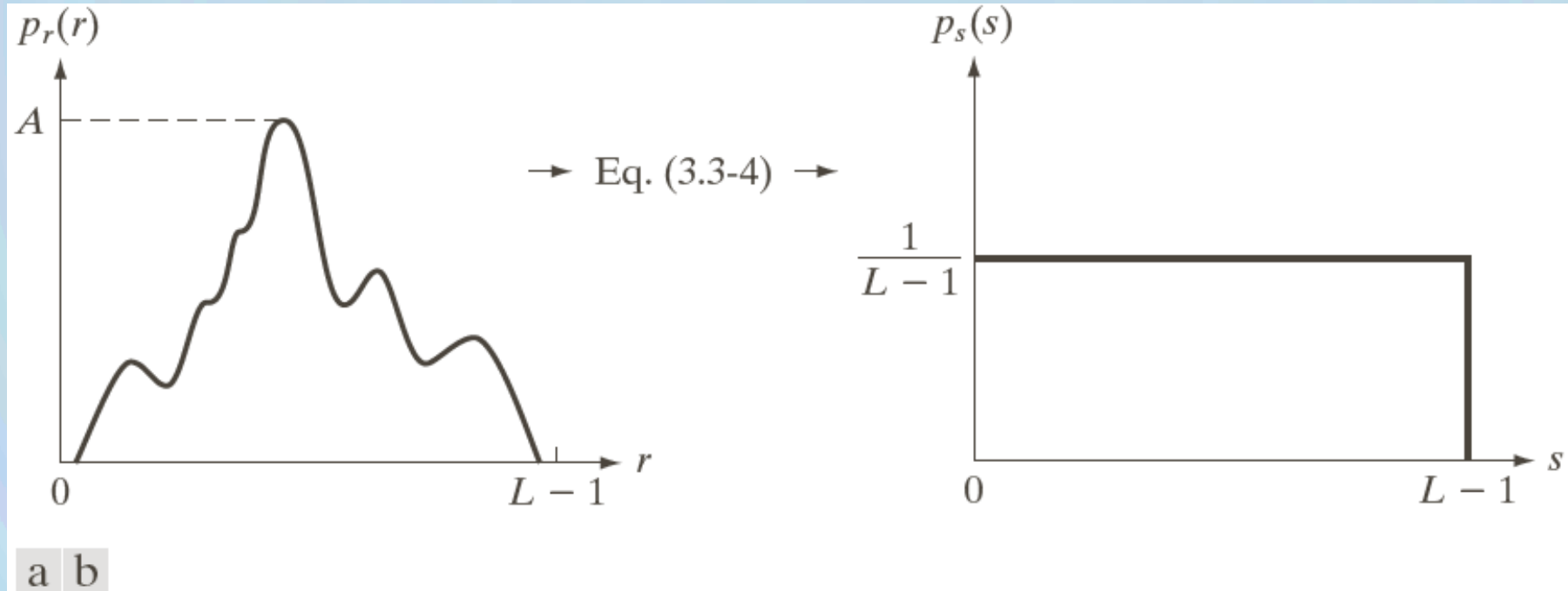


FIGURE 3.18 (a) An arbitrary PDF. (b) Result of applying the transformation in Eq. (3.3-4) to all intensity levels, r . The resulting intensities, s , have a uniform PDF, independently of the form of the PDF of the r 's.

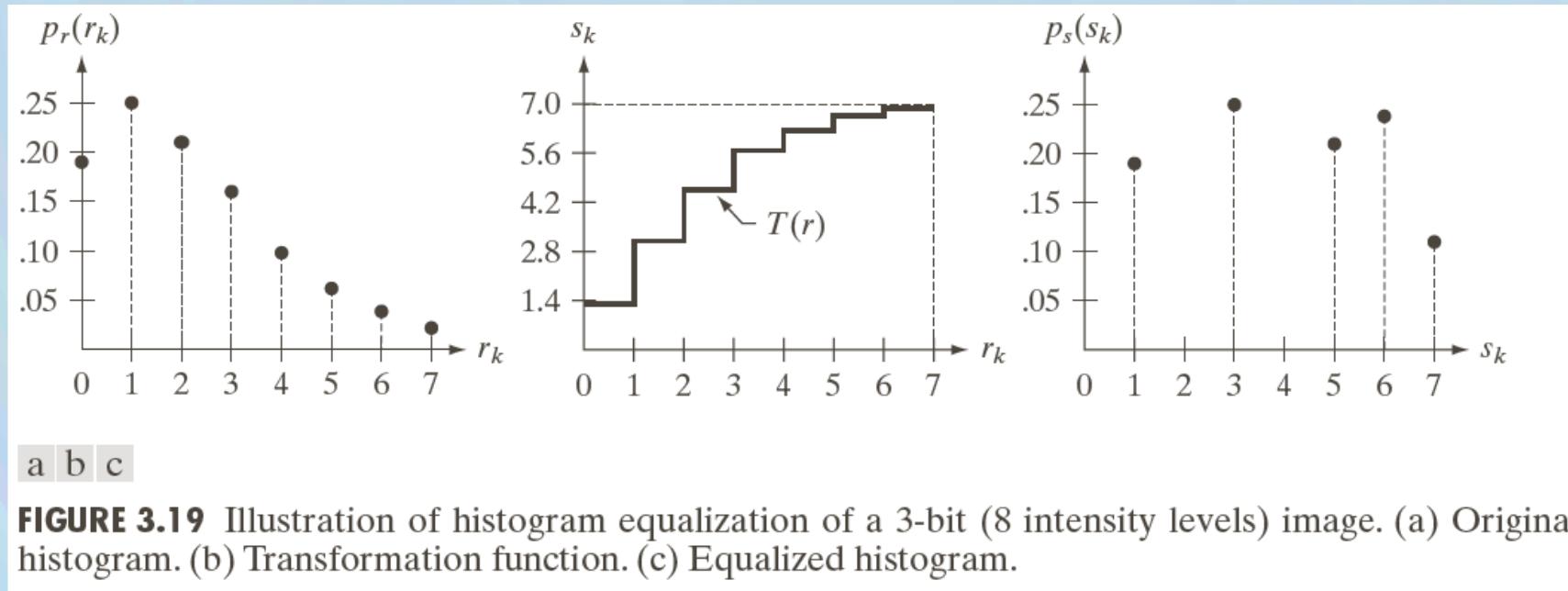
Histogram Eşitleme - Örnek

r_k	n_k	$p_r(r_k) = n_k/MN$
$r_0 = 0$	790	0.19
$r_1 = 1$	1023	0.25
$r_2 = 2$	850	0.21
$r_3 = 3$	656	0.16
$r_4 = 4$	329	0.08
$r_5 = 5$	245	0.06
$r_6 = 6$	122	0.03
$r_7 = 7$	81	0.02

TABLE 3.1

Intensity distribution and histogram values for a 3-bit, 64×64 digital image.

Histogram Eşitleme - Örnek



Histogram Eşitleme

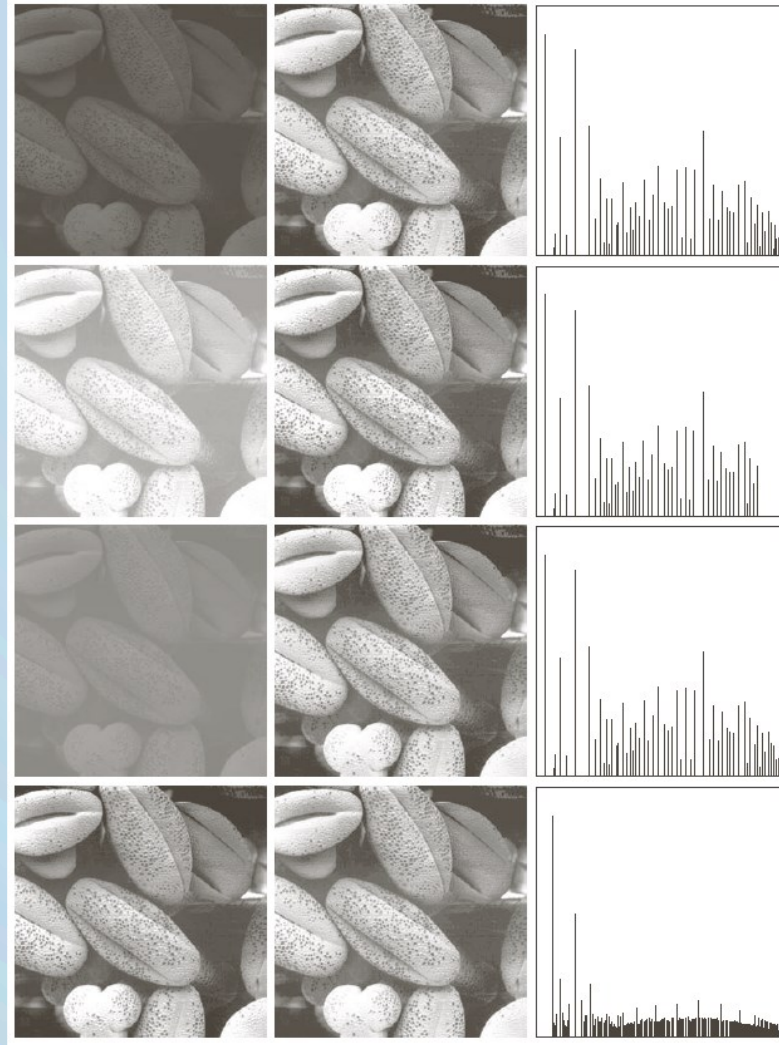


FIGURE 3.20 Left column: images from Fig. 3.16. Center column: corresponding histogram-equalized images. Right column: histograms of the images in the center column.

Histogram Eşitleme

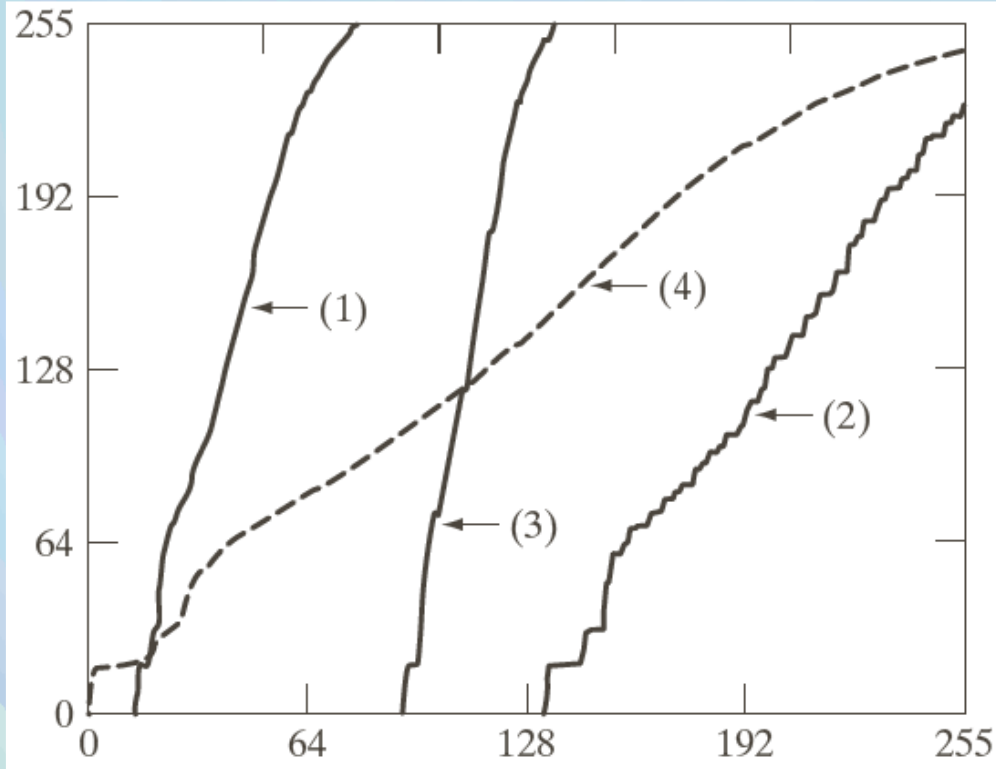
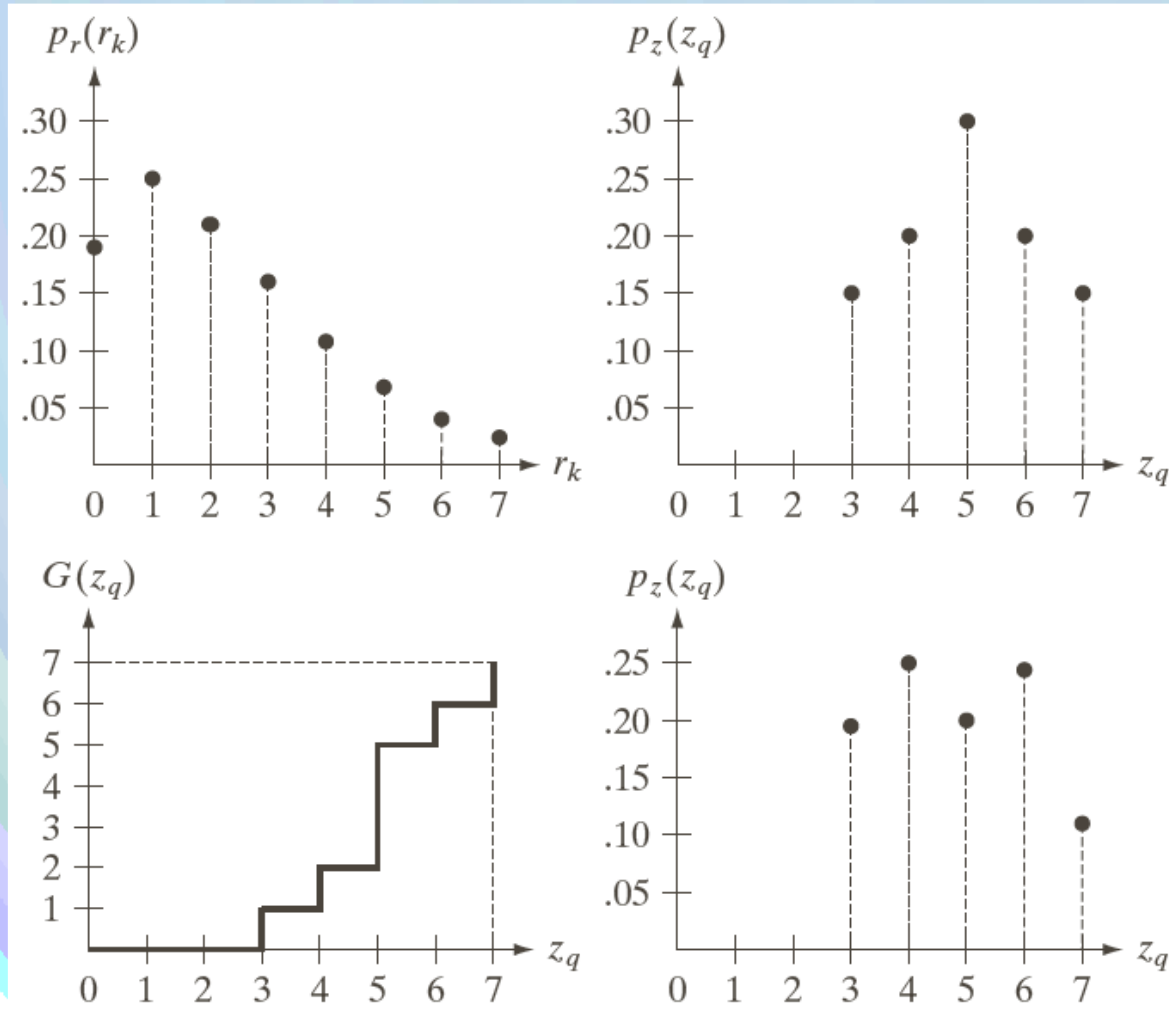


FIGURE 3.21
Transformation functions for histogram equalization. Transformations (1) through (4) were obtained from the histograms of the images (from top to bottom) in the left column of Fig. 3.20 using Eq. (3.3-8).

Histogram Eşleştirme

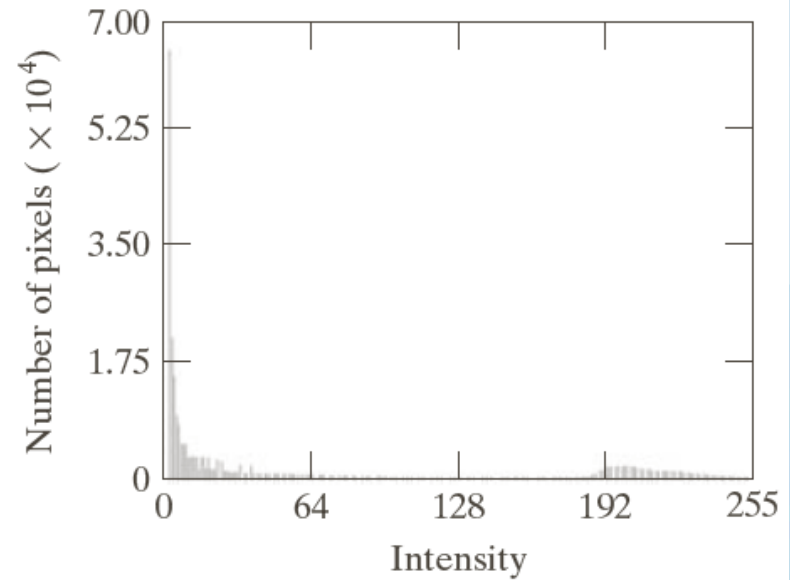
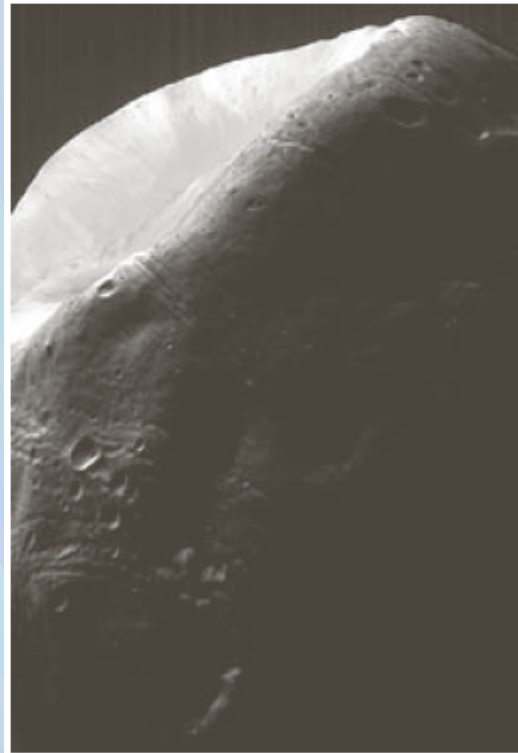


a	b
c	d

FIGURE 3.22

(a) Histogram of a 3-bit image. (b) Specified histogram. (c) Transformation function obtained from the specified histogram. (d) Result of performing histogram specification. Compare (b) and (d).

Histogram Eşleştirme

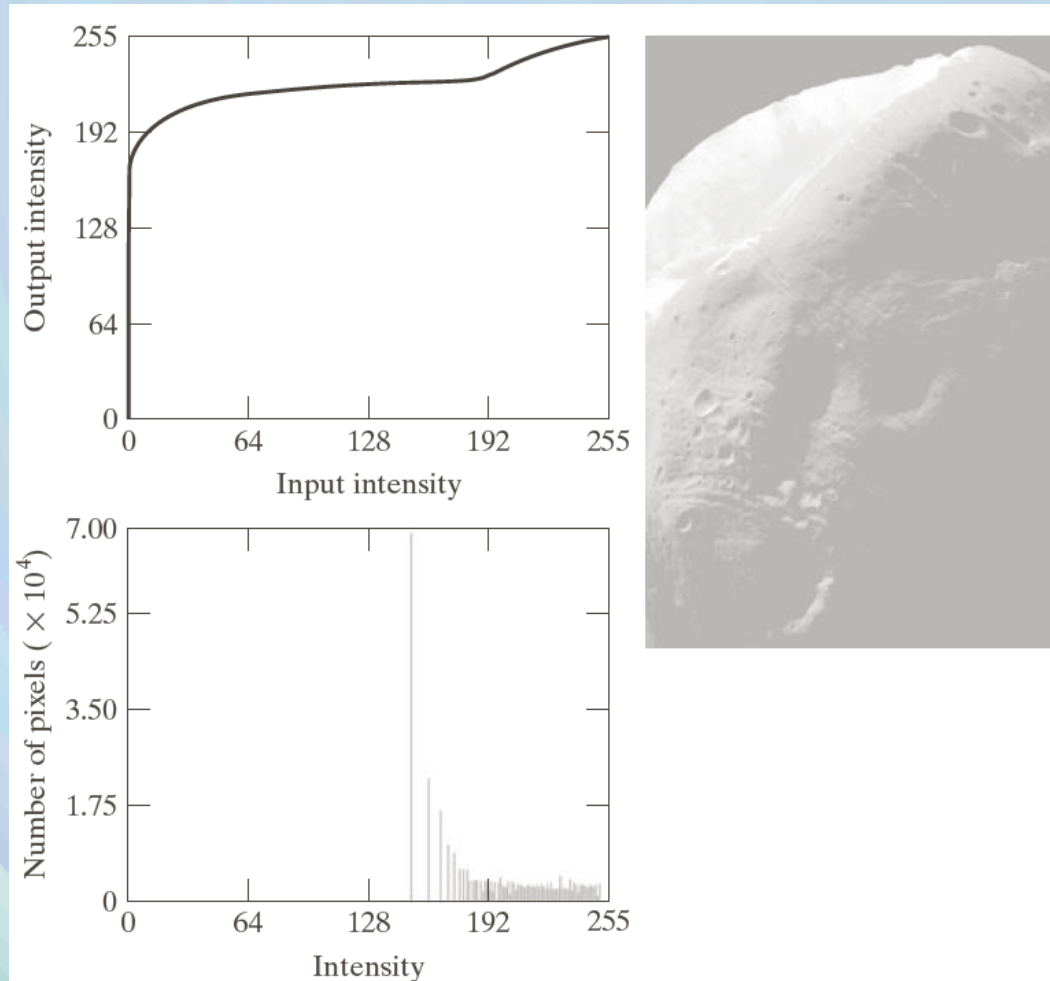


a b

FIGURE 3.23

(a) Image of the Mars moon Phobos taken by NASA's *Mars Global Surveyor*. (b) Histogram. (Original image courtesy of NASA.)

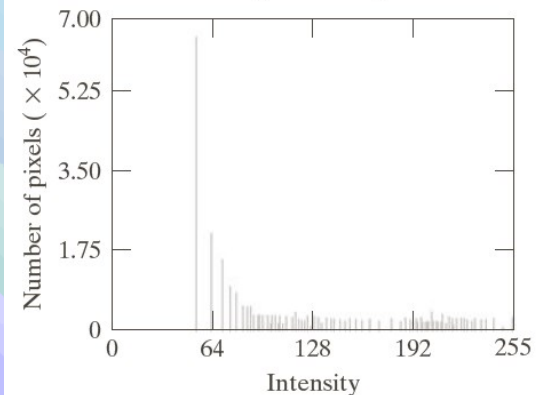
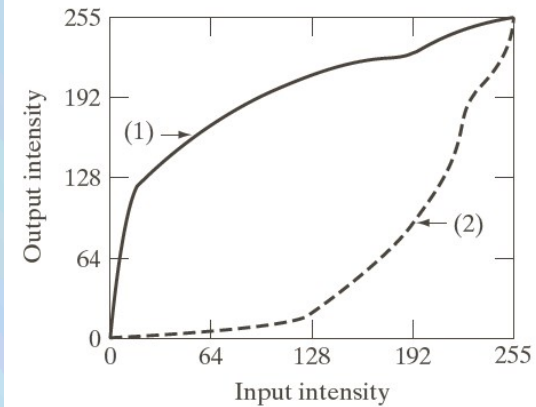
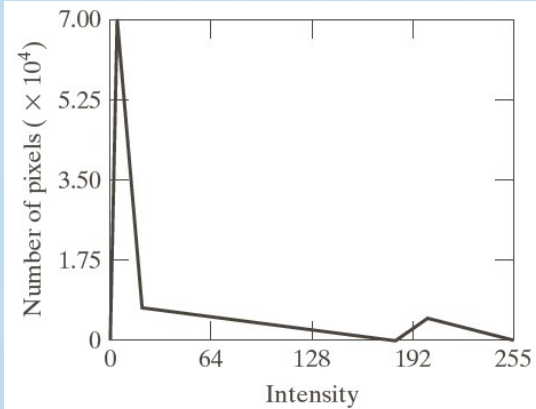
Histogram Eşleştirme



a b
c

FIGURE 3.24
(a) Transformation function for histogram equalization.
(b) Histogram-equalized image (note the washed-out appearance).
(c) Histogram of (b).

Histogram Eşleştirme



a c
b
d

FIGURE 3.25
(a) Specified histogram.
(b) Transformations.
(c) Enhanced image using mappings from curve (2).
(d) Histogram of (c).