APPENDIX D

Gaussian Probabilities

(1) $P(X > \mu_X + y\sigma_X) = Q(y) = \int_y^\infty \frac{1}{\sqrt{2\pi}} \exp\left(\frac{-z^2}{2}\right) dz$

(2) $Q(0) = \frac{1}{2}$; $Q(-y) = 1 - Q(y)$, when $y \geq 0$

(3) $Q(y) \approx \frac{1}{y\sqrt{2\pi}} \exp\left(\frac{-y^2}{2}\right)$ when $y > 4$

(4) $\text{erfc}(y) \triangleq \frac{2}{\sqrt{\pi}} \int_y^\infty \exp(-z^2)\, dz = 2Q(\sqrt{2}y), y > 0.$

TABLE D.1 GUASSIAN PROBABILITIES

y	$Q(y)$	y	$Q(y)$	y	$Q(y)$	$Q(y)$	y
.05	.4801	1.05	.1469	2.10	.0179		
.10	.4602	1.10	.1357	2.20	.0139		
.15	.4405	1.15	.1251	2.30	.0107	10^{-3}	3.10
.20	.4207	1.20	.1151	2.40	.0082		
.25	.4013	1.25	.1056	2.50	.0062		
.30	.3821	1.30	.0968	2.60	.0047	$\frac{10^{-3}}{2}$	3.28
.35	.3632	1.35	.0885	2.70	.0035		
.40	.3446	1.40	.0808	2.80	.0026		
.45	.3264	1.45	.0735	2.90	.0019	10^{-4}	3.70
.50	.3085	1.50	.0668	3.00	.0013		
.55	.2912	1.55	.0606	3.10	.0010		
.60	.2743	1.60	.0548	3.20	.00069		
.65	.2578	1.65	.0495	3.30	.00048	$\frac{10^{-4}}{2}$	3.90
.70	.2420	1.70	.0446	3.40	.00034		
.75	.2266	1.75	.0401	3.50	.00023		
.80	.2119	1.80	.0359	3.60	.00016	10^{-5}	4.27
.85	.1977	1.85	.0322	3.70	.00010		
.90	.1841	1.90	.0287	3.80	.00007		
.95	.1711	1.95	.0256	3.90	.00005	10^{-6}	4.78
1.00	.1587	2.00	.0228	4.00	.00003		

Source: K. Sam Shanmugan, *Digital and Analog Communication Systems,* John Wiley & Sons, New York, 1979, pp. 583–84.