Chapter 2

2-1.1 a) Continuous random variables:

High temperature ; ±5°

Low temperature: ±5°

Wind ; ± 3 mph

Humidity ; ± 5%

THI ; ± 5°

Sunrise ; ± 1 min

Sunset : ± min

b) Continuous random variables:

Average speed ; ± 5 mph

Cars to trucks ratio ; ± 2

Average weight ; ± 500 lbs

Discrete random variables:

Vehicles per minute ; ± 5

accidents / Day ; ± 2

c) Continuous random variables

Value of resistance ; ± 100 Ohms

Value of capacitance ; ± 0.005 μf

Value of voltage ; ± 0.5 V

2-1.2 a) Discrete ; 2 to 12

b) Continuous ; 11.5 to 12.5

c) Discrete ; 000 000 to 999 999

d) Continuous ; 100 to 500 (lb)

2-2.1 b) 0.37597

c) 0.05469

2-2.2 a) 0

b) 0.125

c) 0.5

2-2.3 a) $A = 1$

b) 0.6321

c) 0.3679

d) 0.8647

2-2.4 a) $A = \frac{1}{2}$ $b = \frac{\pi}{4}$

b) $\frac{1}{2} - \frac{\sqrt{2}}{4}$

c) $\frac{1}{2}$

2-3.1 b) 0.7734

c) 0.1718

2-3.2 a) $f_X(x) = e^{-(x-1)}$ $1 < x < \infty$

b) 0.2325

c) 0.6321

2-3.3 a) $f_Y(y) = \frac{1}{\sqrt{y}} e^{-2\sqrt{|y|}}$

b) $e^{-2\sqrt{2}}$

2-3.4 a) $f_Y(y) = \frac{1}{3}\left[e^{-2\left|\frac{y+4}{3}\right|}\right]$ $-\infty < y < \infty$

b) 0.9653

c) 9.158×10^{-3}

2-4.1 a) 2

b) 5

c) 1

2-4.2 a) 0

b) 0.758

c) 0

d) 0.758

2-4.3 a) $K = \frac{1}{18}$

b) 4

c) 18

d) 2

e) -1.6

f) $\frac{2}{n+1} 6^n$

2-4.4 a) 12.5

b) 93.75

c) 0.000977

2-4.5 a) 6/31

b) 2

c) 15/3

2-5.1 a) 0.8944

b) 0.3944

c) 0.1057

2-5.2 a) 1875

b) 26875

c) 0

d) 175

2-5.3 a) 1

b) 4

c) 0.8413

2-5.5 a) 0.2867×10^{-6}

b) 0.9987

2-6.1 a) 12

b) 288

c) 0.0832

2-6.2 a) $f_Y(y) = \frac{1}{3y^{2/3}} \frac{1}{\sqrt{2\pi}} e^{-\frac{y^{2/3}}{2}}$

b) 0

c) 15

2-6.3 a) 32 W

b) 0.3127

c) 0.1054

2-6.4 a) 4 ft/sec

b) 5.01 ft/sec

c) 0.0434

2-6.5 a) 6.412×10^4 $(m/sec)^2$

b) 531 m/s

c) 253 m/s

2-6.6 a) 5

b) 10

c) 3

2-6.7 a) $f_X(x) = \frac{4.343}{\sqrt{2\pi}\,\sigma_Y\, x} \exp\left\{ -\frac{(10\log_{10}(x) - \mu_Y)^2}{2\sigma_Y} \right\}$

b) $\mu_X = \exp\left\{ \frac{\log(10)}{10}\mu_Y + \frac{1}{2}\left(\frac{\sigma_Y}{4.343}\right)^2 \right\}$

c) $\sigma_X^2 = \left[\exp\left(\frac{\sigma_Y}{4.343}\right)^2 - 1\right]\left[\exp\left(2\left\{\frac{\log(10)}{10}\mu_Y + \frac{1}{2}\left(\frac{\sigma_Y}{4.343}\right)^2\right\}\right)\right]$

2-7.1 a) $f_X(x) = \frac{1}{\pi\sqrt{1-x^2}} \quad -1 \le x \le 1$

b) 0

c) 1/2

d) 1/3

2-7.2 a) $n \geq 57.3$

b) 2^6

c) 6

2-7.3 a) 0.632

b) 0.184

c) 0.0667

2-7.4 a) 8000

b) 0.265

c) 0.865

2-7.5 a) $f(x) = \frac{1}{8}[\delta(x+7) + \delta(x+5) + \delta(x+3) + \delta(x+1) + \delta(x-1) + \delta(x-3) + \delta(x-5) + \delta(x-7)]$

b) 0

c) 21

2-8.1 a) 0.3679

b) 8

2-8.2 a) $f(x|M) = \frac{2}{x\sqrt{1-x^2}} \quad 0 \le x \le 1$

b) $E[X|M] = \frac{2}{\pi}$

2-8.3 a) 0.0978

b) 0.9725

2-8.4 a) 5.1856

b) 8.0044

2-9.1 a) 7.979

b) 12.533

2-9.2 a) $f(r|R>r_0) = \frac{\frac{r}{\sigma^2} e^{-\frac{r^2}{2\sigma^2}}}{1-\left[1-e^{-\frac{r_0^2}{2\sigma^2}}\right]} \quad r \ge 0$

b) 1.376

2-9.3 a)

$$f(V_0) \begin{cases} \Phi(-A) & \text{if } V_0 = -B \\ \frac{1}{\sqrt{2\pi}\,\sigma_{V_0}} \exp\left\{ -\frac{1}{2\sigma_{V_0}^2} (V_0 - \mu_{V_0})^2 \right\} & \text{if } -B < V_0 < B \\ \Phi(-A) & \text{if } V_0 = B \end{cases}$$

b) 2.55

2-9.4 a) $f(V_t) = \dfrac{1}{2\pi\sqrt{100 - V_t^2}} \qquad -5 < V_t < 5$

b) 0

c) 25