Exercise 3-18 with $f(x) = \frac{8}{7}\left(\frac{1}{2}\right)^x, x = 1, 2, 3$

(a) $P(X \leq 1) = f(1) = \frac{4}{7} \approx 0.5714$

(b) $P(X > 1) = f(2) + f(3) = \frac{2}{7} + \frac{1}{7} = \frac{3}{7} \approx 0.4286$

(c) $P(2 < X < 6) = P(X = 3) = \frac{1}{7} \approx 0.1429$

(d) $P(X \leq 1 \text{ or } X > 1) = 1$

CDF:

- $x < 1$: $F(x) = 0$
- $1 \leq x < 2$: $F(x) = \frac{4}{7}$
- $2 \leq x < 3$: $F(x) = \frac{6}{7}$
- $x \geq 3$: $F(x) = 1$

(a) $P(X < 1.5) = F(1) = \frac{4}{7} \approx 0.5714$

(b) $P(X \leq 3) = F(3) = 1$

(c) $P(X > 2) = 1 - F(2) = 1 - \frac{6}{7} = \frac{1}{7} \approx 0.1429$

(d) $P(1 < X \leq 2) = F(2) - F(1) = \frac{6}{7} - \frac{4}{7} = \frac{2}{7} \approx 0.2857$

Exercise 3-60 Mean and Variance

$$E[X] = \sum_{x=1}^{3} x \cdot f(x) = 1 \cdot \frac{4}{7} + 2 \cdot \frac{2}{7} + 3 \cdot \frac{1}{7} = \frac{4+4+3}{7} = \frac{11}{7} \approx 1.5714$$

$$E[X^2] = \sum_{x=1}^{3} x^2 \cdot f(x) = 1^2 \cdot \frac{4}{7} + 4 \cdot \frac{2}{7} + 9 \cdot \frac{1}{7} = \frac{4+8+9}{7} = \frac{21}{7} = 3$$

$$\text{Var}(X) = E[X^2] - (E[X])^2 = 3 - \left(\frac{11}{7}\right)^2 = 3 - \frac{121}{49} = \frac{147-121}{49} = \frac{26}{49} \approx 0.5306$$

Exercise 3-85

Discrete uniform from 5 to 9 pages:

$$\mu = 7, \quad \sigma = \sqrt{2}$$

Exercise 3-101

Phone lines occupied 40% of time, $n = 10$ calls:

(a) $P(\text{exactly 3 occupied}) = 0.2150$

(b) $P(\text{at least one not occupied}) = 0.9999$

(c) $E[\text{occupied calls}] = 4$

Exercise 3-103

Traffic light green 20% of time:

(a) $P(\text{exactly 1 green in 5 days}) = 0.4096$

(b) $P(\text{exactly 4 green in 20 days}) = 0.2182$

(c) $P(\text{more than 4 green in 20 days}) = 0.3704$

Exercise 3-123

Optical alignment success $p = 0.8$:

(a) $P(\text{first success on 4th trial}) = 0.0064$

(b) $P(\text{first success in} \leq 4 \text{ trials}) = 0.9984$

(c) $P(\text{first success in} \geq 4 \text{ trials}) = 0.0080$

Exercise 3-137

Camera test failure probability $q = 0.2$:

(a) $P(\text{2nd failure on 10th test}) = 0.0604$

(b) $P(\text{2nd failure in} \leq 4 \text{ tests}) = 0.1808$

(c) $E[\text{tests until 3rd failure}] = 15$

Exercise 3-145

Marker prevalence 30%, sample of 10 men:

(a) $P(\text{exactly 1 has marker}) = 0.1211$

(b) $P(\text{more than 1 has marker}) = 0.8507$

Exercise 3-160

Poisson process, $\lambda = 10$ per hour:

(a) $P(\text{exactly 5 calls in 1 hour}) = 0.0378$

(b) $P(3 \text{ or fewer calls in 1 hour}) = 0.0103$

(c) $P(\text{exactly 15 calls in 2 hours}) = 0.0516$

(d) $P(\text{exactly 5 calls in 30 minutes}) = 0.1755$