Statistics Final Review Answer Key
For Chapters 7, 8, 9 + 10 by Michael Reiner

1. a) 
   \[ x = \text{Cakes Sold} \]
   \[ y = p(x) \text{ after multiplying each } p(x) \times 100 \]
   \[ u = 2 \]

   b)
   \[ t = 1 \]

   c)
   \[ t^2 = 1^2 = 1 \]

   d)
   \[ p(x > 3) = p(x = 4) \]
   \[ p(x > 3) = 0.10 \]

   e)
   \[ p(x < 2) = p(x = 0) + p(x = 1) \]
   \[ 0.05 + 0.25 = 0.30 \]

   f)
   \[ p(x \geq 1) = p(x = 1) + p(x = 2) + p(x = 3) + p(x = 4) \]
   \[ p(x \geq 1) = 1 - p(x = 0) \]
   \[ 1 - 0.05 = 0.95 \]

   g)
   \[ x = 0, 1, 2, 3, 4 \]
   \[ y = 2(0) + 5 = 5 \]
   \[ 0.05 \]
   \[ y = 2(1) + 5 = 7 \]
   \[ 0.25 \]
   \[ y = 2(2) + 5 = 9 \]
   \[ 0.45 \]
   \[ y = 2(3) + 5 = 11 \]
   \[ 0.15 \]
   \[ y = 2(4) + 5 = 13 \]
   \[ 0.10 \]
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1. h) \( x = \text{Cookie's Gold} \)
\( y = P(x) \) after multiplying \( P(x) \times 100 \)
\[ \mu = 9 \quad \sigma^2 = 4 \]

i) Expected Value: \( E = 2 \)
\[ E(x) + c = 2(2) + 5 \]
\[ 4 + 5 = 9 \]
Laws of Variance: \( V = 2 \quad x = 0 \quad c = 0 \)
\[ V(c) = 0 \]
\[ V(x) = 2^2(1) = 4 \]

2. a) \( p = 40\% = 0.40 \quad n = 20 \quad P(x = 3) \)
\[ P(x = 3) = \frac{20!}{3!(20-3)!} \times 0.40^3 (1-0.40)^{20-3} \]
\[ = 1140 (0.064)(0.6)^{17} \]
\[ = 1140 (0.064)(0.000169267) = 0.01234969 \]
\[ P(x = 3) = 0.0123 \]

b) \( p = 40\% = 0.40 \quad n = 20 \quad P(x \geq 2) \)
\[ P(x \geq 2) = 1 - P(x < 2) = 1 - P(x \leq 1) \]
\[ 1 - 0.0005 = 0.9995 \]

c) \( p = 40\% = 0.40 \quad n = 20 \quad P(x \leq 4) \)
\[ P(x \leq 4) = 0.0510 \]
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2. d) \[ P(X > 4) = P = 40\% = 0.40 \quad n = 20 \]
\[ P(X > 4) = 1 - P(X \leq 4) \]
\[ = 1 - 0.0510 = 0.9490 \]

e) \[ P(X \leq 3) = P = 40\% = 0.40 \quad n = 20 \]
\[ P(X \leq 3) = P(X \leq 2) \]
\[ P(X \leq 3) = 0.0036 \]

f) Expected value = \[ \mu = np \]
\[ n = 20 \quad p = 40\% = 0.40 \]
\[ \mu = 20 \times 0.40 = 8 \]

g) \[ \chi^2 = np(1-p) \]
\[ n = 20 \quad p = 40\% = 0.40 \]
\[ \chi^2 = 20 \times (0.40)(1-0.40) \]
\[ \chi^2 = 4.8 \]

h) \[ \Gamma = \sqrt{\chi^2} \]
\[ \Gamma = \sqrt{4.8} \]
\[ \Gamma = 2.19 \]

3. \[ \mu = 0.8/\text{chapter} \]
\[ P(X = 2) \text{ in two chapters} \]
\[ \therefore \quad \mu = 0.8 \times 2 = 1.6 \]
\[ e^{-\mu} \frac{(\mu)^x}{x!} \cdot e^{-1.6} \frac{(1.6)^2}{2} = 0.201896518 \times 2.58 = 0.2584 \]
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4. a) \( Z = \frac{X - \mu}{\sigma} = \frac{840 - 800}{45} \)
    \[ Z = \frac{840 - 800}{45} = 2.22 \]
    \[ Z \approx 0.968 \]
    \[ 0.968 - 0.8133 = 0.1747 \]

b) \( X = ? \)
    \[ Z = \frac{X - \mu}{\sigma} = \frac{840 - 800}{45} \]
    \[ Z = \frac{X - 800}{45} \]
    \[ 1 - 0.05 = 0.95 \]
    \[ 0.95 = \frac{X - 800}{45} \]
    \[ 0.95 \times 45 = X - 800 \]
    \[ 42.75 = X - 800 \]
    \[ X = 842.75 \]

4c) \( X = ? \)
    \[ Z = \frac{X - \mu}{\sigma} = \frac{X - 800}{45} \]
    \[ Z = \frac{X - 800}{45} \]
    \[ 1.28 = \frac{X - 800}{45} \]
    \[ 1.28 \times 45 = X - 800 \]
    \[ 57.60 = X - 800 \]
    \[ X = 857.60 \]
5. a) 
\[ \mu = \$800 \quad \sigma = \$125 \quad n = 40 \]
\[ \overline{X} = \frac{\sum X}{n} = \frac{125}{40} = 3.125 \quad \text{[Corrected]} \]
\[ \overline{X} = \frac{125}{40} = 3.125 \]
\[ \text{SE} = \frac{125}{\sqrt{40}} = 19.764 \]
\[ z = \frac{3.125 - 19.764}{125.55532} = -0.002 \]

b) 
\[ X < 2750 \quad \mu = \$800 \quad \sigma = \$125 \quad n = 40 \]
\[ z = \frac{2750 - 800}{125} = 7.5 \]
\[ \frac{125}{\sqrt{40}} = 19.764 \]
\[ z = \frac{7.5 - 19.764}{125.55532} = -0.002 \]

6. 
\[ p = 0.38 \quad n = 650 \quad \bar{p} = 0.42 \]
\[ \frac{0.38 \times 650}{650} = 247 > 5 \]
\[ (1 - 0.38) \times 650 = 413 > 5 \]
\[ \bar{p} = \frac{0.42}{n} = 0.0063 \]
\[ z = \frac{0.42 - 0.38}{\sqrt{0.38(1 - 0.38)} / \sqrt{650}} = \frac{0.42 - 0.38}{0.04} = 0.42 \]
\[ 0.38 \]
\[ z = \frac{1 - 0.38}{0.019038423} = 0.9821 \]
\[ z = 0.04 \]

7. 
Regular: \[ n_1 = 55 \quad n_2 = 40 \]
\[ \overline{X}_1 = 5.5 \quad \overline{X}_2 = 4.8 \]
\[ Z = \frac{5.5 - 4.8}{\sqrt{\frac{55}{50} + \frac{4.8^2}{40}}} = \frac{0.7}{0.3} = 3 \]

Detailed: \[ n_1 = 50 \]
\[ \overline{X}_1 = 5.5 \quad \overline{X}_2 = 4.8 \]
\[ Z = \frac{(X_1 - X_2) - (5.5 - 5.8)}{\sqrt{\frac{112}{50} + \frac{144}{40}}} = \frac{0.3}{0.3} = 1 \]
\[ z = \frac{1.1}{0.0831} = 1.31 = 0.8665 \]
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8. \( \bar{x} = 2.3 \quad n = 8 \quad CI = 98\% \quad \bar{x} = 23.1625 \)
\[ 1 - 0.98 = 0.02 = 0.0100 \]
\[ \frac{0.0100}{2} = 0.0050 \]
\[ \bar{x} \pm z_{\alpha/2} \frac{s}{\sqrt{n}} = 23.1625 \pm 2.33 \left( \frac{2.3}{\sqrt{8}} \right) \]
\[ 23.1625 \pm 2.33 \times 0.81317 = 23.1625 \pm 1.8947 \]
\[ LI = 23.1625 - 1.8947 = 21.2678 \]
\[ UL = 23.1625 + 1.8947 = 25.0572 \]

9. \( \sigma = 6 \quad p = 0.75 \quad CI = 90\% \quad z = 1.645 \quad n = \frac{(z)^2}{\hat{p}(1-\hat{p})} \)
\[ n = \left( \frac{1.645 \times 6}{0.75} \right)^2 = \frac{(1.645)^2}{(0.75)(0.25)} = (13.16)^2 = 173.18 \approx 174 \]