2.5

4

a

$$\begin{aligned}\mu_V &= \mu_{V_1+V_2} \\ &= \mu_{V_1} + \mu_{V_2} \\ &= 12 + 6 \\ &= 18\end{aligned}$$

b

$$\begin{aligned}\sigma_V^2 &= \sigma_{V_1+V_2}^2 \\ &= \sigma_{V_1}^2 + \sigma_{V_2}^2 \\ \sigma_V &= \sqrt{1^2 + .5^2} \\ &= 1.12\end{aligned}$$

8

a

$$\begin{aligned}\mu_{\text{case}} &= \mu_{24*\text{bottle}} \\ &= 24\mu_{\text{bottle}} \\ &= 24 * 20.01 \\ &= 480.24 \text{ ounces}\end{aligned}$$

b

$$\begin{aligned}\sigma_{\text{case}} &= \sigma_{24*\text{bottle}} \\ &= |24|\sigma_{\text{bottle}} \\ &= 24 * .02 \\ &= .48 \text{ ounces}\end{aligned}$$

c

$$\begin{aligned}E(\bar{x}) &= \frac{E(24 * x)}{24} \\ &= \frac{24}{24} * 20.01 \\ &= 20.01\end{aligned}$$

d

$$
\begin{aligned}
\sigma &= \sqrt{\frac{\sigma_x^2}{n-1}} \\
&= \frac{\sigma_x}{\sqrt{n-1}} \\
&= \frac{.02}{4.795} \\
&= .00417
\end{aligned}
$$

e

$$
\begin{aligned}
\sigma &= \sqrt{\frac{\sigma_x^2}{n-1}} \\
.0025 &= \frac{.002}{\sqrt{n-1}} \\
n-1 &= \frac{.02}{.0025}^{2} \\
n &= 8^2 + 1 \\
&= 65
\end{aligned}
$$

4.2

2

$$p(x) = P(X = x) = \frac{n!}{x!(n-x)!} P^x (1-p)^{n-x}$$

$$P(x) = \frac{9!}{x!(9-x)!} (.4)^x (1-.4)^{9-x}$$

a $P(X > 6) = P(7) + P(8) + P(9) = .02123 + .00354 + .0000262 = .0250$

b $P(X \geq 2) = 1 - (P(0) + P(1)) = 1 - (.07054) = .929$

c $P(2 \leq X < 5) = p(2) + P(3) + P(4) = .1612 + .2508 + .2508 = .6628$

d $P(2 < X \geq 5) = p(2) + P(3) + P(4) = .1672 + .2508 + .2508 = .6688$

e $P(0) = \frac{9!}{0!(9-0)!}(.4)^0(1-.4)^{9-0} = .010$

f $P(7) = \frac{9!}{7!(9-7)!}(.4)^7(1-.4)^{9-7} = .0213$

g $\mu_X = np = 9 * .4 = 3.6$

h $\sigma_X^2 = np(1-p) = 2.16$

4

a Bin(10,.75) $\Rightarrow P(X=10) = \frac{10!}{10!}.75^10 * (0.75)^{10-10} = .05631$

b $P(X=8) = \frac{10!}{8*!(10-8)!}.75^8 * (0.75)^{10-8} = .282$

c $P(X \geq 8) = P(X=8) + P(X=9) + P(X=10) = .282 + .1877 + .05631 = .5256$

8

a $P(X=4) = \frac{20!}{4!(20-4)!}.2^4 * (0.25)^{20-4} = .218$

b $P(X<3) = P(X=0) + P(X=1) + P(X=2) = .0116 + .0575 + .136$

c $P(X=0) = \frac{20!}{0!(20-0)!}.2^0 * (0.25)^{20-0} = .01153$

d $n * p = 20 * .20 = 4$

e $\sqrt{n * p(1-p)} = \sqrt{4(.8)} = 1.79$

22

$$
\begin{aligned}
x &= \text{Bin}(n,p) \\
&\Rightarrow \\
P(X=x) &= \binom{n}{x} * p^x (1-p)^{n-x} \\
\text{let x= n-x} \\
Y(X=n-x) &= \binom{n}{n-x} * p^{n-x}(1-p)^{n-(n-x)} \\
&= \binom{n}{x} * p^{n-x}(1-p)^x \\
&= \binom{n}{x} * (1-p)^x p^{n-x}
\end{aligned}
$$

This implies $p = (1-p)$ if n-x = X.

4.3

2 Has a mean of 6 pits per cm^2 this implies a Poisson(6) distribution.

a $P(X=8) = p(8) = e^{-6}\frac{6^8}{8!} = .103$

b $P(X=2) = p(2) = e^{-6}\frac{6^2}{2!} = 0.045$

c $P(X<3) = p(0) + p(1) + p(2) = .062$

d $P(X>1) = 1 - (p(1) + p(0)) = .982$

e $\mu_x = \lambda = 6$

f $\sigma_x = \sqrt{\lambda} = \sqrt{6} = 2.45$

4 poisson distribution with average of 6 tracks $\Rightarrow \lambda = 6$

a $P(x = 7) = p(7) = e^{-6}\frac{6^7}{7!} = .13767$

b $P(X \geq 3) = 1 - (p(0) + p(1) + p(2)) = .938$

c $P(2 < X < 7) = p(3) + p(4) + p(5) + p(6) = .544$

d $\mu_X = \lambda = 6$

e $\sigma_X^2 = \lambda \Rightarrow \sigma_X = \sqrt{\lambda} = \sqrt{6} = 2.45$

14

$$\begin{aligned} P(X = 0) = 0.1353 &= e^{-\lambda} * \frac{\lambda^0}{0!} \\ &= e^{-\lambda} \\ &\Rightarrow \\ \lambda &= \ln(.1353) \\ &= 2 \\ \mu_X &= \lambda \\ &= 2 \end{aligned}$$