

Warning: not all of these answers have been carefully checked. If you disagree with one of them, you may be correct.

1. (a) r_1/r ; r_2/r ; $\binom{r_1}{2}/\binom{r}{2}$, $r_1 r_2/\binom{r}{2}$, $\binom{r_2}{2}/\binom{r}{2}$. (b) $(r_1 + 3r_2)/r$, $4r_1 r_2/r^2$, $-4r_1 r_2/r^2(r-1)$.
 (c) $n(r_1 + 3r_2)/r$, $4nr_1 r_2(r_1 + r_2 - n)/r^2(r-1)$.

2. (a) Gamma (2,3/2), (b) $c = 1$, (b) 3/2, $2 \log 2$. (c) $2 - 3 \log 2$.

3. (a) 1/4. (b) $1 - \Phi((35 - 25)/(30\sqrt{3}/2)) = 1 - \Phi(0.385) = 0.3501$.

4. (a) $\binom{6}{5}p^5(1-p) + \binom{6}{6}p^6$. (b) $\sum_{k=0}^3 \left[\binom{3}{k} p^k (1-p)^{3-k} \right]^2$. (c) $p(1-p)^3$.

5. $P(\text{Urn } k) = 6/11, 3/11, 2/11$ for $k = 1, 2, 3$; $29/22$.

6. $f_Z(z) = 0$ if $z < 0$, $f_Z(z) = 3(e^{-x} - e^{-3x})/2$, $z > 0$. $f(z) = 7e^{-3(z-2)}/6 - e^{-3z}/6$ if $2 \leq z$.

7. (a) $E[X] = 25$, $\text{Var}(X) = 25/3$. (b) $\Phi(.69) - \Phi(-1.39) = .6726$. (c) $a = 9.13$.

8. (a)

$y \setminus x$	1	2	3	4	5	6	$p_Y(y)$
0	5/36	4/36	3/36	2/36	1/36	0	5/12
1	1/36	2/36	3/36	4/36	5/36	6/36	7/12
$p_X(x)$	1/6	1/6	1/6	1/6	1/6	1/6	

(b) $7/2$, $7/12$, $35/12$, $35/144$, $35/72$.

(c)

z	1	2	3	4	5	6	7
$p_Z(z)$	5/36	5/36	5/36	5/36	5/36	5/36	6/36

9. (i) $13 \cdot \binom{12}{2} \cdot 4 \cdot 4 / \binom{52}{6}$, (ii) $\binom{13}{3} \binom{4}{2}^3 / \binom{52}{6}$, (iii) $\binom{13}{2} \binom{4}{3}^2 / \binom{52}{6}$, (iv) $\left[\binom{13}{2} \binom{4}{3}^2 + 13 \cdot 12 \cdot \binom{4}{4} \binom{4}{2} \right] / \binom{52}{6}$,
 (v) $8 \cdot 4^6 / \binom{52}{6}$, (vi) $\binom{13}{6} 4^6 / \binom{52}{6}$, (vii) $13 \cdot 12 \cdot 11 \cdot \binom{4}{3} \binom{4}{2} \binom{4}{1} / \binom{52}{6}$.

10. (a) $M_X(t) = e^t(e^{(n+1)t} - 1)/n(e^t - 1)$; (b) $M_X(t)^k$.

11. See the book.

12. $18/25$.

13. (a) $E[X_i] = 1 - \binom{19N}{10} / \binom{20N}{10}$, $\text{Var}(X_i) = \left(1 - \binom{19N}{10} / \binom{20N}{10} \right) \left(\binom{19N}{10} / \binom{20N}{10} \right)$,

$\text{Cov}(X_i, X_j) = E[X_i X_j] - E[X_i]E[X_j] = \left(1 - 2\binom{19N}{10} / \binom{20N}{10} + \binom{18N}{10} / \binom{20N}{10} \right) - \left(1 - \binom{19N}{10} / \binom{20N}{10} \right)^2$,
 $E[X] = 20E[X_i]$, $\text{Var}(X) = 20 \text{Var}(X_i) + (20 \cdot 19) \text{Cov}(X_i, X_j)$.

(b) $X = 10$, $E[X] = 10$, $\text{Var}(X) = 0$. Check: $E[X_i] = 1/2$, $\text{Var}(X_i) = 1/4$, $\text{Cov}(X_i, X_j) = -1/76$.

(c) $E[X_i] = 1 - (19/20)^{10}$, $\text{Var}(X_i) = (1 - (19/20)^{10})(19/20)^{10}$,
 $\text{Cov}(X_i, X_j) = (1 - 2(19/20)^{10} + (18/20)^{10}) - (1 - (19/20)^{10})^2$,
 $E[X] = 20E[X_i]$, $\text{Var}(X) = 20 \text{Var}(X_i) + (20 \cdot 19) \text{Cov}(X_i, X_j)$.

(d) $\binom{19N}{10} / \binom{20N}{10} = \left(\frac{19N}{20N} \right) \left(\frac{19N-1}{20N-1} \right) \cdots \left(\frac{19N-9}{20N-9} \right) \rightarrow \left(\frac{19}{20} \right)^{10}$, etc.

14. $1 - 3(2/3)^n + 3(1/3)^n$.

15. See book or class notes.