Precalculus
11.3 HW Answers

1. a. $\left({}_6C_2\right)(0.2)^2(0.8)^4 = 0.24576$ or binomialpdf $(n=6,\ p=0.2,\ k=2) = 0.24576$
   b. X = # of wins: **<u>0 1 2</u>** 3 4 5 6
      $P(X \le 2) =$ binomialcdf $(n=6,\ p=0.2,\ k=2) = 0.90112$
   c. X = # of wins: 0 1 2 **<u>3 4 5 6</u>**
      $P(X > 2) = 1 - P(X \le 2) = 1 -$ binomialcdf $(n=6,\ p=0.2,\ k=2) = 0.09888$

2. a. $\left({}_7C_4\right)\left(\frac{1}{3}\right)^4\left(\frac{2}{3}\right)^3 \approx 0.1280$ or binomialpdf $\left(n=7,\ p=\frac{1}{3},\ k=4\right) \approx 0.1280$
   b. X = # of times freight elevator responds: **<u>0 1 2 3</u>** 4 5 6 7
      $P(X < 4) = P(X \le 3) =$ binomialcdf $\left(n=7,\ p=\frac{1}{3},\ k=3\right) \approx 0.8267$
   c. X = # of times freight elevator responds: 0 1 2 3 **<u>4 5 6 7</u>**
      $P(X \ge 4) = 1 - P(X \le 3) = 1 -$ binomialcdf $\left(n=7,\ p=\frac{1}{3},\ k=3\right) \approx 0.1733$

3. X = # of coin flip wins: 0 … 15 16 17 18 **<u>19 20 21 22 23 24 25</u>**
   $P(X \ge 19) = 1 - P(X \le 18) = 1 -$ binomialcdf $(n=25,\ p=0.5,\ k=18) \approx 0.0073$

4. a. 2 misses, then bullseye: $(0.75)^2(0.25) = 0.140625$ or geometricpdf $(p=0.25,\ k=3) = 0.140625$
   b. X = shot when first bullseye occurs: **<u>1 2 3</u>** 4 5 …
      $P(X \le 3) = P(X=1) + P(X=2) + P(X=3) = 0.25 + (0.75)(0.25) + (0.75)^2(0.25) = 0.578125$
      or geometriccdf $(p=0.25,\ k=3) = 0.578125$
   c. X = Shot when first bullseye occurs: 1 2 3 **<u>4 5…</u>**
      $P(X > 3) = P(\text{no bullseyes in first 3 shots} - \text{F, F, F}) = (0.75)^3 = 0.421875$
      or $P(X > 3) = 1 - P(X \le 3) = 1 -$ geometriccdf $(p=0.25,\ k=3) = 0.421875$

5. a. $\left({}_{20}C_0\right)(0.03)^0(0.97)^{20} = (0.97)^{20} \approx 0.5438$ or binomialpdf $(n=20,\ p=0.03,\ k=0) \approx 0.5438$
   b. X = # of defective fuses: 0 1 2 3 **<u>4 5 6 7 … 20</u>**
      $P(X > 3) = 1 - P(X \le 3) = 1 -$ binomialcdf $(n=20,\ p=0.03,\ k=3) \approx 0.0027$
   c. X = # of defective fuses: **<u>0 1</u>** 2 3 4 5 6 7 … 20
      $P(X < 2) = P(X \le 1) =$ binomialcdf $(n=20,\ p=0.03,\ k=1) \approx 0.8802$

6. a. 7 non-doubles, then doubles: $\left(\frac{5}{6}\right)^7\left(\frac{1}{6}\right) \approx 0.0465$ or geometricpdf $\left(p=\frac{1}{6},\ k=8\right) \approx 0.0465$
   b. X = roll when first doubles occurs: **<u>1 2 3 4 5 6 7</u>** 8 9 10 …
      $P(X < 8) = P(X \le 7) =$ geometriccdf $\left(p=\frac{1}{6},\ k=7\right) \approx 0.7209$
      or $P(\text{1st doubles before 8th turn}) = 1 - P(\text{no doubles in first 7 turns}) = 1 - \left(\frac{5}{6}\right)^7 \approx 0.7209$
   c. X = roll when first doubles occurs: 1 2 3 4 5 6 7 8 **<u>9 10 …</u>**
      $P(X > 8) = 1 - P(X \le 8) = 1 -$ geometriccdf $\left(p=\frac{1}{6},\ k=8\right) \approx 0.2326$
      or $P(\text{1st doubles after 8th turn}) = P(\text{no doubles on 1st 8 turns}) = \left(\frac{5}{6}\right)^8 \approx 0.2326$

d. $\left({}_{15}C_3\right)\left(\frac{1}{6}\right)^3\left(\frac{5}{6}\right)^{12} \approx 0.2363$ or binomialpdf $\left(n=15,\ p=\frac{1}{6},\ k=3\right) \approx 0.2363$

e. Y = # of doubles in 15 rolls: 0 1 2 **<u>3 4 5 6 … 15</u>**
$P(Y \geq 3) = 1 - P(Y \leq 2) = 1 -$ binomialcdf $\left(n=15,\ p=\frac{1}{6},\ k=2\right) \approx 0.4678$

f. Y = # of doubles in 15 rolls: **<u>0 1 2 3</u>** 4 5 6 … 15
$P(Y \leq 3) =$ binomialcdf $\left(n=15,\ p=\frac{1}{6},\ k=3\right) \approx 0.7685$

7. a. $\left({}_{4}C_3\right)(0.88)^3(0.12)^1 \approx 0.3271$ or binomialpdf $(n=4,\ p=0.88,\ k=3) \approx 0.3271$

b. $\left({}_{4}C_4\right)(0.88)^4(0.12)^0 = (0.88)^4 \approx 0.5997$ or binomialpdf $(n=4,\ p=0.88,\ k=4) \approx 0.5997$

c. X = # of experts who detect TB: **<u>0 1</u>** 2 3 4
$P(X \leq 2) =$ binomialcdf $(n=4,\ p=0.88,\ k=2) \approx 0.0732$

8. a. 4 non-black, then black: $\left(\frac{20}{38}\right)^4\left(\frac{18}{38}\right) \approx 0.0363$ or geometricpdf $\left(p=\frac{18}{38},\ k=5\right) \approx 0.0363$

b. X = spin on which first black occurs: 1 2 3 **<u>4 5 6 …</u>**
$P(X > 3) = 1 - P(X \leq 3) = 1 -$ geometriccdf $\left(p=\frac{18}{38},\ k=3\right) \approx 0.1458$

or $P(\text{more than 3 spins to first black}) = P(\text{no blacks in first 3}) = \left(\frac{20}{38}\right)^3 \approx 0.1458$

c. X = spin on which first black occurs: … 28 29 30 31 32 **<u>33 34 35 …</u>**
$P(X > 32) = 1 - P(X \leq 32) = 1 -$ geometriccdf $\left(p=\frac{18}{38},\ k=32\right) \approx 0.0000000012$

or $P(\text{more than 32 spins to first black}) = P(\text{no blacks in first 32}) = \left(\frac{20}{38}\right)^{32} \approx 0.0000000012$