10. **(a)** $1 - \binom{5}{0}\left(\frac{1}{3}\right)^0\left(\frac{2}{3}\right)^5 - \binom{5}{1}\left(\frac{1}{3}\right)^1\left(\frac{2}{3}\right)^4 = 0.539.$ **(b)** $\binom{5}{2}\left(\frac{1}{10}\right)^2\left(\frac{9}{10}\right)^3 = 0.073.$

26. **(a)** A four-engine plane is preferable to a two-engine plane if and only if

$$1 - \binom{4}{0}p^0(1-p)^4 - \binom{4}{1}p(1-p)^3 > 1 - \binom{2}{0}p^0(1-p)^2.$$

This inequality gives $p > 2/3$. Hence a four-engine plane is preferable if and only if $p > 2/3$. If $p = 2/3$, it makes no difference.

(b) A five-engine plane is preferable to a three-engine plane if and only if

$$\binom{5}{5}p^5(1-p)^0 + \binom{5}{4}p^4(1-p) + \binom{5}{3}p^3(1-p)^2 > \binom{3}{2}p^2(1-p) + p^3.$$

Simplifying this inequality, we get $3(p-1)^2(2p-1) \geq 0$ which implies that a five-engine plane is preferable if and only if $2p - 1 \geq 0$. That is, for $p > 1/2$, a five-engine plane is preferable; for $p < 1/2$, a three-engine plane is preferable; for $p = 1/2$ it makes no difference.

7. $P(X = 1) = P(X = 3)$ implies that $e^{-\lambda}\lambda = \dfrac{e^{-\lambda}\lambda^3}{3!}$ from which we get $\lambda = \sqrt{6}$. The answer is $\dfrac{e^{-\sqrt{6}}\left(\sqrt{6}\right)^5}{5!} = 0.063.$

14. Choose one month as the unit of time. Then $\lambda = 5$ and the probability of no crimes during any given month of a year is $P\big(N(1) = 0\big) = e^{-5} = 0.0067$. Hence the desired probability is

$$\binom{12}{2}(0.0067)^2(1 - 0.0067)^{10} = 0.0028.$$

8. The probability that at least n light bulbs are required is equal to the probability that the first $n - 1$ light bulbs are all defective. So the answer is p^{n-1}.

15. $$\sum_{i=3}^{5} \frac{\binom{18}{i}\binom{10}{5-i}}{\binom{28}{5}} = 0.772.$$

18. $$1 - \sum_{i=0}^{2}\binom{20}{i}(0.06)^i(0.94)^{20-i} = 0.115.$$

Let X be the number of requests for reservations at the end of the second day. It is reasonable to assume that X is Poisson with parameter $3 \times 3 \times 2 = 18$. Hence the desired probability is

$$P(X \geq 24) = 1 - \sum_{i=0}^{23} P(X = i) = 1 - \sum_{i=0}^{23} \frac{e^{-18}(18)^i}{i!} = 1 - 0.89889 = 0.10111.$$

22. **(a)** $\left(\dfrac{w}{w+b}\right)^{n-1}\left(\dfrac{b}{w+b}\right)$. **(b)** $\left(\dfrac{w}{w+b}\right)^{n-1}$.