1.5

(a) $\left(\frac{5}{6}\right)^N$

(b) (Probability of being shot on the N^{th} trial)
= (Probability of surviving $N-1$ trials) × (Probability of shooting oneself on the N^{th} trial)
$= \left(\frac{5}{6}\right)^{N-1}\left(\frac{1}{6}\right)$

(c) Probability of being shot on the N^{th} trial $= \left(\frac{5}{6}\right)^{N-1}\left(\frac{1}{6}\right)$
$\Rightarrow$ the mean number of times $= \sum_{N=1}^{\infty}\left(\frac{5}{6}\right)^{N-1}\left(\frac{1}{6}\right)\times N = 6$

1.7

The probability of n successes out of N trials is given by the sum

$$W(n) = \sum_{i=1}^{2}\sum_{j=1}^{2}\cdots\sum_{m=1}^{2} w_i w_j \cdots w_m$$

with the restriction that the sum is taken only over terms involving w_1 n times.

Then $$W(n) = \sum_{i=1}^{2} w_i \sum_{j=1}^{2} w_j \cdots\cdots \sum_{m=1}^{2} w_m$$

If we sum over all $i \cdots\cdots m$, each sum contributes (w_1+w_2) and

$$W'(n) = (w_1+w_2)^N$$

$$W'(n) = \sum_{n=0}^{N} \frac{N!}{n!\,(N-n)!} w_1^{\,n} w_2^{\,N-n}$$ by the binomial theorem.

Applying the restriction that w_1 must occur n times we have

$$W(n) = \frac{N!}{n!(N-n)!} w_1^{\,n} w_2^{\,N-n}$$

1.10

(a) $$\sum_{n=0}^{\infty}\frac{\lambda^n}{n!}e^{-\lambda} = e^{-\lambda}\sum_{n=0}^{\infty}\frac{\lambda^n}{n!} = e^{-\lambda}e^{\lambda} = 1$$

(b) $$\bar{n} = \sum_{n=0}^{\infty}\frac{n\lambda^n e^{-\lambda}}{n!} = \lambda e^{-\lambda}\frac{\partial}{\partial\lambda}\left(\sum\frac{\lambda^n}{n!}\right) = \lambda e^{-\lambda}e^{\lambda} = \lambda$$

(c) $$\overline{n^2} = \sum_{n=0}^{\infty}\frac{n^2\lambda^n}{n!}e^{-\lambda} = e^{-\lambda}\left(\lambda\frac{\partial}{\partial\lambda}\right)^2\left(\sum\frac{\lambda^n}{n!}\right) = \lambda^2+\lambda$$

$$\overline{(\Delta n)^2} = \overline{n^2} - \bar{n}^2 = \lambda$$

1.11

(a) The mean number of misprints per page is 1.

Thus $\quad W(n) = \frac{\lambda^n}{n!} e^{-\lambda} = \frac{e^{-1}}{n!}$

and $\quad W(0) = e^{-1} = 0.37$

(b) $\quad P = 1 - \sum_{n=0}^{2} \frac{e^{-1}}{n!} = 0.08$