doesn't spend any time with the student, then Z will be equal to $X+Y$. On the other hand, if the professor is interrupted by the student, then the length of time will be equal to $X+Y+R$. This is because the professor will spend the same amount of total time on the task regardless of whether he is interrupted by the student. Therefore,

$$\mathbf{E}[Z] = \mathbf{P}(F)\mathbf{E}[Z \mid F] + \mathbf{P}(F^c)\mathbf{E}[Z \mid F^c] = \mathbf{P}(F)\mathbf{E}[X+Y+R] + \mathbf{P}(F^c)\mathbf{E}[X+Y].$$

Using the results of the earlier calculations,

$$\mathbf{E}[X+Y] = 5,$$

$$\mathbf{E}[X+Y+R] = \mathbf{E}[X+Y] + \mathbf{E}[R] = 5 + \frac{1}{2} = \frac{11}{2}.$$

Therefore,

$$\mathbf{E}[Z] = 0.68 \cdot 5 + 0.32 \cdot \frac{11}{2} = 5.16.$$

Thus the expected time the professor will leave his office is 5.16 hours after 9 a.m.

Solution to Problem 4.29. The transform is given by

$$M(s) = \mathbf{E}[e^{sX}] = \frac{1}{2}e^{s} + \frac{1}{4}e^{2s} + \frac{1}{4}e^{3s}.$$

We have

$$\mathbf{E}[X] = \frac{d}{ds}M(s)\bigg|_{s=0} = \frac{1}{2} + \frac{2}{4} + \frac{3}{4} = \frac{7}{4},$$

$$\mathbf{E}[X^2] = \frac{d^2}{ds^2}M(s)\bigg|_{s=0} = \frac{1}{2} + \frac{4}{4} + \frac{9}{4} = \frac{15}{4},$$

$$\mathbf{E}[X^3] = \frac{d^3}{ds^3}M(s)\bigg|_{s=0} = \frac{1}{2} + \frac{8}{4} + \frac{27}{4} = \frac{37}{4}.$$

Solution to Problem 4.30. The transform associated with X is

$$M_X(s) = e^{s^2/2}.$$

By taking derivatives with respect to s, we find that

$$\mathbf{E}[X] = 0, \quad \mathbf{E}[X^2] = 1, \quad \mathbf{E}[X^3] = 0, \quad \mathbf{E}[X^4] = 3.$$

Solution to Problem 4.31. The transform is

$$M(s) = \frac{\lambda}{\lambda - s}.$$

Thus,

$$\frac{d}{ds}M(s) = \frac{\lambda}{(\lambda - s)^2}, \qquad \frac{d^2}{ds^2}M(s) = \frac{2\lambda}{(\lambda - s)^3}, \qquad \frac{d^3}{ds^3}M(s) = \frac{6\lambda}{(\lambda - s)^4},$$