85. Solution: B
Denote the policy premium by P. Since x is exponential with parameter 1000, it follows from what we are given that E[X] = 1000, Var[X] = 1,000,000, $\sqrt{\text{Var}[X]} = 1000$ and P = 100 + E[X] = 1,100. Now if 100 policies are sold, then Total Premium Collected = 100(1,100) = 110,000.
Moreover, if we denote total claims by S, and assume the claims of each policy are independent of the others then E[S] = 100 E[X] = (100)(1000) and Var[S] = 100 Var[X] = (100)(1,000,000). It follows from the Central Limit Theorem that S is approximately normally distributed with mean 100,000 and standard deviation = 10,000. Therefore,

$$P[S \geq 110,000] = 1 - P[S \leq 110,000] = 1 - P[Z \leq \frac{110,000 - 100,000}{10,000}] = 1 - P[Z \leq 1] = 1 - 0.841 \approx 0.159.$$

86. Solution: E
Let $X_1, \ldots, X_{100}$ denote the number of pensions that will be provided to each new recruit. Now under the assumptions given,

$$X_i = \begin{cases} 
0 & \text{with probability } \ 1 - 0.4 = 0.6 \\
1 & \text{with probability } \ (0.4)(0.25) = 0.1 \\
2 & \text{with probability } \ (0.4)(0.75) = 0.3 \\
\end{cases}$$

for $i = 1, \ldots, 100$. Therefore,

$$E[X_i] = (0)(0.6) + (1)(0.1) + (2)(0.3) = 0.7,$$

$$E[X_i^2] = (0)^2(0.6) + (1)^2(0.1) + (2)^2(0.3) = 1.3,$$

and

$$\text{Var}[X_i] = E[X_i^2] - (E[X_i])^2 = 1.3 - (0.7)^2 = 0.81.$$

Since $X_1, \ldots, X_{100}$ are assumed by the consulting actuary to be independent, the Central Limit Theorem then implies that $S = X_1 + \ldots + X_{100}$ is approximately normally distributed with mean

$$E[S] = E[X_1] + \ldots + E[X_{100}] = 100(0.7) = 70$$

and variance

$$\text{Var}[S] = \text{Var}[X_1] + \ldots + \text{Var}[X_{100}] = 100(0.81) = 81.$$

Consequently,

$$\Pr[S \leq 90.5] = \Pr\left[\frac{S - 70}{9} \leq \frac{90.5 - 70}{9}\right] = \Pr[Z \leq 2.28] = 0.99$$