\[ \Pr[X_b - X_A \geq 0] = \Pr \left[ Z \geq \frac{1000}{2000\sqrt{2}} \right] \quad (Z \text{ is standard normal}) \]

\[ = \Pr \left[ Z \geq \frac{1}{2\sqrt{2}} \right] \]

\[ = 1 - \Pr \left[ Z < \frac{1}{2\sqrt{2}} \right] \]

\[ = 1 - \Pr [Z < 0.354] \]

\[ = 1 - 0.638 = 0.362 \]

Finally,

\[ \Pr \left[ \left( I_A^c \land I_B \right) \cup \left( \left( I_A \land I_B \right) \cap (X_A < X_B) \right) \right] = 0.18 + (0.12)(0.362) \]

\[ = 0.223 \]

43. Solution: D

If a month with one or more accidents is regarded as success and \( k \) = the number of failures before the fourth success, then \( k \) follows a negative binomial distribution and the requested probability is

\[ \Pr[k \geq 4] = 1 - \Pr[k \leq 3] = 1 - \sum_{i=0}^{3} \binom{3+i}{i} \left( \frac{3}{5} \right)^{i} \left( \frac{2}{5} \right)^{4} \]

\[ = 1 - \left( \frac{3}{5} \right)^{4} \left[ \binom{3}{0} \left( \frac{2}{5} \right)^{0} + \binom{4}{1} \left( \frac{2}{5} \right)^{1} + \binom{5}{2} \left( \frac{2}{5} \right)^{2} + \binom{6}{3} \left( \frac{2}{5} \right)^{3} \right] \]

\[ = 1 - \left( \frac{3}{5} \right)^{4} \left[ 1 + \frac{8}{5} + \frac{8}{5} \frac{32}{25} \right] \]

\[ = 0.2898 \]

Alternatively the solution is

\[ \left( \frac{2}{5} \right)^{4} + \binom{4}{1} \left( \frac{2}{5} \right)^{3} \frac{3}{5} + \binom{5}{2} \left( \frac{2}{5} \right)^{2} \left( \frac{3}{5} \right)^{2} + \binom{6}{3} \left( \frac{2}{5} \right)^{3} \left( \frac{3}{5} \right)^{3} = 0.2898 \]

which can be derived directly or by regarding the problem as a negative binomial distribution with

i) success taken as a month with no accidents
ii) \( k \) = the number of failures before the fourth success, and
iii) calculating \( \Pr[k \leq 3] \)