

**Question #13****Answer: D**

Let NS denote non-smokers, S denote smokers.

$$\begin{aligned}\text{Prob}(T < t) &= \text{Prob}(T < t | \text{NS}) \times \text{Prob}(\text{NS}) + \text{Prob}(T < t | \text{S}) \times \text{Prob}(\text{S}) \\ &= (1 - e^{-0.1t}) \times 0.7 + (1 - e^{-0.2t}) \times 0.3 \\ &= 1 - 0.7e^{-0.1t} - 0.3e^{-0.2t}\end{aligned}$$

$$S_0(t) = 0.3e^{-0.2t} + 0.7e^{-0.1t}$$

Want  $\hat{t}$  such that  $0.75 = 1 - S_0(\hat{t})$  or  $0.25 = S_0(\hat{t})$

$$0.25 = 0.3e^{-2\hat{t}} + 0.7e^{-0.1\hat{t}} = 0.3(e^{-0.1\hat{t}})^2 + 0.7e^{-0.1\hat{t}}$$

Substitute: let  $x = e^{-0.1\hat{t}}$

$$0.3x^2 + 0.7x - 0.25 = 0$$

This is quadratic, so  $x = \frac{-0.7 \pm \sqrt{0.49 + (0.3)(0.25)4}}{2(0.3)}$

$$x = 0.3147$$

$$e^{-0.1\hat{t}} = 0.3147 \quad \text{so } \hat{t} = 11.56$$