Solution to (41) Answer: (C)

The payoff function of the contingent claim is

$$\pi(s) = \min(42, s) = 42 + \min(0, s - 42) = 42 - \max(0, 42 - s) = 42 - (42 - s)_+$$

The time-0 price of the contingent claim is

$$\begin{aligned} V(0) &= F^P_{0,1}[\pi(S(1))] \\ &= \text{PV}(42) - F^P_{0,1}[(42 - S(1))_+] \\ &= 42e^{-0.07} - P(45, 42, 0.25, 0.07, 1, 0.03). \end{aligned}$$

We have $d_1 = \dfrac{\ln(45/42) + (0.07 - 0.03 + ½(0.25)^2 \times 1)}{0.25\sqrt{1}} = 0.560971486$

and $d_2 = 0.310971486$. From the Cumulative Normal Distribution Calculator, $N(-d_1) = N(-0.56097) = 0.28741$ and $N(-d_2) = N(-0.31097) = 0.37791$.

Hence, the time-0 put price is

$$P(45, 42, 0.25, 0.07, 1, 0.03) = 42e^{-0.07}(0.37791) - 45e^{-0.03}(0.28741) = 2.247951,$$

which implies

$$V(0) = 42e^{-0.07} - 2.247951 = 36.91259.$$

$$\begin{aligned} \text{Elasticity} &= \frac{\partial \ln V}{\partial \ln S} \\ &= \frac{\partial V}{\partial S} \times \frac{S}{V} \\ &= \Delta_V \times \frac{S}{V} \\ &= -\Delta_{\text{Put}} \times \frac{S}{V}. \end{aligned}$$

$$\begin{aligned} \text{Time-0 elasticity} &= e^{-\delta T} N(-d_1) \times \frac{S(0)}{V(0)} \\ &= e^{-0.03} \times 0.28741 \times \frac{45}{36.91259} \\ &= 0.340025. \end{aligned}$$

Remark: We can also work with $\pi(s) = s - (s - 42)_+$; then

$$V(0) = 45e^{-0.03} - C(45, 42, 0.25, 0.07, 1, 0.03)$$

and

$$\frac{\partial V}{\partial S} = e^{-\delta T} - \Delta_{\text{call}} = e^{-\delta T} - e^{-\delta T} N(d_1) = e^{-\delta T} N(-d_1).$$