Solution to (72) Answer: (A)

Let K_1 denote the strike price (which is 95 in this problem), K_2 denote the payment trigger (which is 120), and T denote the exercise date (which is ½). Let $I(.)$ the denote the indicator function.

The payoff of the gap call is $(S^a(T) - K_1)\times I(S^a(T) > K_2)$ with $a = 2$.
The payoff of the gap put is $(K_1 - S^a(T))\times I(S^a(T) < K_2) = -(S^a(T) - K_1)I(S^a(T) < K_2)$.

Let α be a real number, A be an event and $\tilde{A}$ be its complement. Obviously,

$$\alpha I(A) + \alpha I(\tilde{A}) = \alpha \,.$$

It follows from this identity that

$$(S^a(T) - K_1)\times I(S^a(T) > K_2) - (K_1 - S^a(T))\times I(S^a(T) < K_2) = S^a(T) - K_1$$

(the right-hand side which is independent of K_2). By considering the prices of these time-T payoffs, we have a generalization of *put-call parity*:

$$\text{price of gap call} - \text{price of gap put} = F_{0,T}^P(S^a - K_1) = F_{0,T}^P(S^a) - K_1e^{-rT} \,.$$

To evaluate $F_{0,T}^P(S^a)$, we use the "Black-Scholes framework" assumption. It follows from (20.30) of McDonald (2006) that

$$F_{0,T}^P(S^2) = S^2(0)e^{[-r+2(r-\delta)+\sigma^2]T} \,.$$

Solving the equation

$$5.543 - (-4.745) = (10)^2 e^{[-0.07+2(0.07-\delta)+0.01]\times ½} - 95e^{-0.07\times ½}$$

yields

$$\delta = 0.02.$$

Remark: Formula (20.30) of McDonald (2006) can be derived as follows:

$$\begin{aligned} F_{0,T}^P(S^a) &= \text{E*}[e^{-rT}S^a(T)] \\ &= e^{-rT}S^a(0)\text{E*}[e^{a[(r-\delta-½\sigma^2)T+\sigma\tilde{Z}(T)]}] \\ &= e^{-rT}S^a(0)e^{a(r-\delta-½\sigma^2)T}\text{E*}[e^{a\sigma\tilde{Z}(T)}] \\ &= e^{-rT}S^a(0)e^{a(r-\delta-½\sigma^2)T}e^{½(a\sigma)^2T} \end{aligned}$$