Reading 77

VALUING A DERIVATIVE USING A ONE-PERIOD BINOMIAL MODEL

1. (B) **the risk-free rate, the volatility of the price of the underlying, and the current asset price.**

   Explanation

   The risk-free rate, the volatility of the price of the underlying, and the current asset price are three of the required variables needed to value an option with a one-period binomial model. The risk-adjusted rate of return and (actual) probability of an up-move are not required.

   (Module 77.1, LOS 77.a)

2. (B) **selling the underlying, buying the call, and investing at the risk-free rate.**

   Explanation

   Using put-call parity and then rearranging to isolate the put:

   $S_0 + p_0 = c_0 + X(1 + r)^{-T}$

   $p_0 = c_0 - S_0 + X(1 + r)^{-T}$

   The put is overpriced; therefore, it should be sold (left side of rearranged equation). Therefore, the components of the right side of the equation should be transacted: buy a call, sell the underlying, and invest at the risk-free rate.

   (Module 77.1, LOS 77.b)

3. (A) **combining options with the underlying asset in a specific ratio will produce a risk-free future payment.**

   Explanation

   A portfolio of an option position and a position in the underlying asset can be constructed so that the portfolio value at option expiration is certain, the same for an up-move and for a down-move.

   (Module 77.1, LOS 77.a)

4. (C) **0.50.**

   Explanation

   With a stock price of 22 at expiration, the short call payoff is –4.

   With a stock price of 14 at expiration, the call payoff is zero.

   The appropriate hedge ratio is (4 – 0) / (22 – 14) = 0.5.

Portfolio value: 0.5(22) – 4 = 0.5(14) = 7

A portfolio of 0.5 shares of stock to 1 short call option will produce the same portfolio value whether the stock price at expiration is 22 or 14.

(Module 77.1, LOS 77.a)

5. (C) **finding a combination of the call option and the underlying that will have the same value regardless of the price of the underlying at expiration.**

Explanation

A portfolio combining the call option with the underlying asset can be constructed that will have the same value at option expiration whether there is an up-move or a down move in the asset price. The present value of this portfolio is the discounted present value of the certain future payment, which can then be used to value the option. An option valuation model based on risk neutrality uses risk-neutral pseudo-probabilities of an up-move and a down-move, not actual probabilities. The average call value is not a certain future payment.

(Module 77.1, LOS 77.a)

6. (A) **expected probabilities of underlying price increases or decreases only.**

Explanation

An option's value is not affected by the actual (real-world) probabilities of underlying price increases or decreases, but is only affected by the expected probabilities.

(Module 77.1, LOS 77.b)

7. (C) decrease Drinsky's call option price.

Explanation

Falling interest rates will decrease the value of a call option. Decreasing the risk-free rate will increase the risk neutral probability (π) of a price decrease and decrease the presentvalue of the expected option payoff. Since the value of a call option is positively related tothe price of the underlying asset, an increased probability of a downward price movewill reduce the expected payoff from the call. As a result, both of those effects will reduce the call option value as the return on risk-free investments decreases.

(Module 77.1, LOS 77.b)

8. (B) $1.30.

Explanation

The risk neutral probability () of an upward price move

= (1 + r – Rd) / (Ru – Rd)

= (1 + 0.03 –0.90) / (1.10 – 0.90) = 0.65.

Therefore the π of a downward price move = 1 – 0.65 = 0.35.

[0.65 × Max (0, $33 – $31)] + [0.35 × Max (0, $27 – $31)] = $1.30

(Module 77.1, LOS 77.b)

9. (C) **Risk-neutral pricing can be applied to any model that uses future underlying asset price movements.**

Explanation

Risk-neutral pricing requires expected volatility (and not expected return) to price an option.

Risk-neutral probabilities are determined using the risk-free rate and assumed "up gross returns" and "down gross returns" (not investor views on risk).

(Module 77.1, LOS 77.b)