Konvexity

Solutions to Item Sets

1. Correct Answer is C: The no-arbitrage futures price = $(C_0 – P_0)/(1+R_f)^T + X = (3.8-1.0)/1.05^{180/365} + 25$ = $27.73.
2. Correct Answer is B: The put-call parity equation for a futures contract is: $C_0 + X/(1+R_f)^T = P_0 + F_T/(1+R_f)^T$. The value of left hand side of the equation is $28.20 and the value of the right hand side is $27.84. Total arbitrage profit equals 28.20 – 27.84 = $0.36.
3. Correct Answer is A: To make arbitrage profit, David took long position in the right hand side of the equation and short position in the left hand side of the equation.
4. Correct Answer is B: Statements 1 and 3 are correct. Statement 2 is wrong as explained in the question 5. Statement 4 is wrong because the gamma is similar to the convexity (second derivative) in the fixed income securities rather than duration.
5. Correct Answer is C: Thetas are positive when the put is deep-in-the money, the volatility is low, the interest rate is high, and the time to expiration is low.
6. Correct Answer is C: In case of put delta, the position will be similar to the position in the underlying. So, the position will be long and the total options needed to be bought = 1,000/0.40 = 2,500.

7. Correct Answer is C: Swap rate for dollar denominated loan = $(1-z_4)/ (z_1+z_2+z_3+z_4)$. z_1=1/ (1+0.0350*180/360) = 0.9828. z_2 = 1/ (1+0.038*360/360) = 0.9634. z_3= 1/ (1+0.042*540/360) = 0.9407. z_4=1/ (1+0.045*720/360) = 0.9174. Swap rate = 0.0217*360/180 = 4.34%.
   For JPY denominated loan, z_1=1/ (1+0.012*180/360) = 0.9940. z_2=1/ (1+0.015*360/360) = 0.9852. z_3=1/ (1+0.017*540/360) = 0.9751. z_4= 1/ (1+0.02*720/360) = 0.9615.Swap rate = 0.0098*360/180 = 1.96%.
8. Correct Answer is B: Semi-annual coupon for dollar-denominated bond = 0.0217*500,000,000/92 = $117,955. Semi-annual coupon for JPY denominated loan = JPY500, 000,000*0.009822= JPY 4910907. The value of dollar denominated bond = 117,955/ (1+0.052*90/360) + (500,000,000/92 + 117,955)/ (1+0.06*270/360) = $5,430,066. The value of JPY denominated loan = 4,910,907/ (1+0.021*90/360) + (500,000,000 + 4,910,907)/ (1+0.023*270/360) = JPY501, 234,149 = $501,234,149/88 = $5,695,842.5. The value of swap to the company = 5,695,842.5 – 5,430,066 = $265,776.5.
9. Correct Answer is A: At the end of the contract, the USD loan party has to pay $500,000,000/92 + $117,955 = $5,552,738.2. The JPY loan party has to pay = JPY500, 000,000 + JPY4, 910,907 = JPY504, 910,907 = $5,610,121.6. The value of swap to the company = 5,610,121.6 – 5,552,738.2 = $57,383.4.
10. Correct Answer is C: The Company has a net liability exposure for floating interest rate payment i.e. it is floating rate payer. To lock-in the maximum fixed rate, the company can enter into the 1X5 payer swaption i.e. the company has the option to enter into the swap as the fixed rate payer and receive the floating rate.
11. Correct Answer is C: Statement 2 is correct.

12. Correct Answer is C: The currency swap contract is most likely to have a higher credit risk at the end of the contract because the most of the credit risk arises due to the change in the exchange rate.

13. Correct Answer is A: The value of floating rate bond = $100 million. The quarterly coupon received by Paparica = 0.06*90/360*$100 million = $1.5 million. z_1=1/ (1+0.055*90/360) = 0.9864. z_2= 1/ (1+0.06*180/360) =0.9709. z_3= 1/ (1+0.065*270/360) = 0.9535. z_4=1/ (1+0.07*360/360) = 0.9346. Value of fixed rate bond = $1.5 million*(0.9864+0.9709+0.9535+0.9346) + $100 million*0.9346 = $99,230,077. Note that we have used LIBOR+1% in our calculations. The value of swap for Paparica = 99,226,053 – 100,000,000 = -$773,947.
14. Correct Answer is B: The swap rate = $[(1-z_4) / (z_1 + z_2 + z_3 + z_4)]*(360.90)$ = 6.80%. Paparica is receiving a fixed rate of 6%. The spread earned by him = 6.00-6.80 = -0.80%.
15. Correct Answer is B: Statement 3 is inaccurate. A fixed rate receiver and floating rate payer will simulate the swap payoff by taking a long position in interest rate put option and short position in interest rate call option.
16. Correct Answer is A: The exchange rate at the end of 6 months = 1.82 USD/GBP. The forward contract rate locked in by Rose = 1.8122 USD/GBP (check solution to the last question). Total loss = (1.8122-1.82)*2 million = $15,569.3.
17. Correct Answer is C: Both will have the same futures price. The future price is not impacted by the volatility of the stocks, the option value is impacted. The dividends will impact only if the dividend payment dates are within the contract period.
18. Correct Answer is B: The forward exchange rate = $1.80*(1.042/1.028)^{0.5}$ = 1.8122 USD/GBP.

19. Correct Answer is B: Rebecca is incorrect about the usage of options. Covered call won't protect the downside movement. Protective put is needed to protect the downside movement.
20. Correct Answer is B: Price of futures contract = $12*(1.06)^{2/12}$ = $12.117. Total value of the futures contract = $12.117*100,000 = $1,211,711. Total initial margin needed = 0.2*1,211,711 = $242,342.
21. Correct Answer is C: Covered call and condor will limit the upside potential. Protective put wouldn't limit the upside potential and also protects from the downside movement.
22. Correct Answer is C: Total return swap takes care of both credit risk and market risk. No credit event is required for it to receive the payments.
23. Correct Answer is B: The counter party has defaulted leading to the replacement risk. Now she has to buy CDS in the market at a higher price.
24. Correct Answer is A: As the market price at the expiry is greater than the futures price, Glori suffered a loss in her short position. Total loss = (14.50-12.117)*100,000 = $238,289.

25. Correct Answer is A: Value of the firm using CCM = $FCFF_1$/ (WACC – g_f) = $2 million/ (0.156-0.058) = $20.408 million.
26. Correct Answer is A: Value of equity = Value of firm – Market value of debt = 20.408 million – 5*1.08 million = $15.008 million. Value of 40% stake = 0.40*15.008 = $6.003 million.

27. Correct Answer is C: No. The weights should be based on the optimal structure weights of the acquiring company which is generally lesser than the weights of the public company for debt. The cost of debt for a private company is generally higher than an established public company. Thus, the optimal debt weight would be lesser than the debt proportion of the publicly trading company.
28. Correct Answer is C: DLOC = 1- 1/ (1+control premium) = 0.20. Thus, control premium = 25%. The value of company with control = 60*(1+0.25) = $75 million. The value of 80% stake = 75*0.8= $60 million.
29. Correct Answer is C: The WACC according to optimal capital structure = 15.6 – 1.8 = 13.8%. The value of firm using optimal WACC = 2 million/ (0.138-0.058) = $25 million. Change in the value of firm = 25 – 20.408 = $4.592 million.
30. Correct Answer is B: Total discount = 1 – (1-DLOC)*(1-DLOM) = 1 – 0.75*0.90= 32.5%. The value of company without discount = 120/ (1-0.325) = $177.78 million.

