Answers to Questions and Problems

1. Explain the differences between a plain vanilla interest rate swap and a plain vanilla currency swap.

   In a plain vanilla interest rate swap, one party pays a fixed rate of interest based on a given nominal amount, while the second party pays a floating rate of interest based on the same nominal amount. No principal is exchanged in the agreement. In a plain vanilla foreign currency swap, there are three different sets of cash flows. First, at the initiation of the swap, the two parties actually do exchange cash. Second, the parties make periodic interest payments to each other during the life of the swap agreement. In the plain vanilla currency swap, one party typically pays dollars at a floating rate, and the payer of the nondollar currency pays a fixed rate. Third, at the termination of the swap, the parties again exchange the principal.

2. Explain the role that the notional principal plays in understanding interest rate swap transactions. Why is this principal amount regarded as only notional? How does it compare with a deliverable instrument in the interest rate futures market?

   The deliverable instrument in the interest rate futures market is like the notional principal in determining the scale of the daily settlement cash flows on the futures contracts. For many futures, however, actual delivery is possible but also avoidable. With an interest rate swap, the notional principal is not ever delivered. If we think of the Eurodollar futures contract, which is only cash-settled, the analogy between the notional principal and the underlying $1,000,000 Eurodollar deposit on a futures is quite close.

   In interest rate swaps, all of the cash flows are based on a notional amount—notional, because the notional principal is not actually paid. This is essentially a matter of convenience in helping to conceptualize the transaction. The entire contract could be stated without regard to the principal amount. One definition of *notional* is "existing in idea only."

3. Consider a plain vanilla interest rate swap. Explain how the practice of net payments works.

   In a typical interest rate swap, each party is scheduled to make payments to the other at certain dates. For the fixed payer, these amounts are certain, but the payments that the floating payer will have to make are unknown at the outset of the transaction. In each period, each party will owe a payment to the other. Rather than make two payments, the party owing the greater amount simply pays the difference between the two obligations.

4. Assume that you are a money manager seeking to increase the yield on your portfolio and that you expect short-term interest rates to rise more than the yield curve would suggest. Would you rather pay a fixed long-term rate and receive a floating short rate, or the other way around? Explain your reasoning.

You would prefer to pay a fixed long-term rate and receive a floating short-term rate. The initial short-term rate that you receive will merely be the spot rate that prevails today. However, if your hunch is correct, the short-term rate will rise more than the market expects, and you will then receive that higher rate. Because your payments are fixed, you will reap a profit from your insight.

5. Assume that the yield curve is flat, that the swaps market is efficient, and that two equally creditworthy counterparties engage in an interest rate swap. Who should pay the higher rate, the party that pays a floating short-term rate or the party that pays a fixed long-term rate? Explain.

They should pay the same. If the yield curve is flat, short-term rates equal long-term rates. Barring a change in rates, the two parties should pay the same amounts to each other in each period. If interest rates change, however, the payments will no longer be the same. If interest rates rise, the party paying the floating payment will lose; if rates fall, the floating payer will benefit.

6. In a currency swap, counterparties exchange the same sums at the beginning and the end of the swap period. Explain how this practice relates to the custom of making interest payments during the life of the swap agreement.

At the outset, the two parties exchange cash denominated in two currencies. Each party pays interest on the currency it receives from the other. Thus, the exchange of currencies is the basis for computing all of the interest payments that will be made over the life of the agreement. The interest payments can be either fixed or floating on both sides of the swap.

7. Explain why a currency swap is also called an "exchange of borrowings."

In a currency swap, both parties pay and both parties receive actual cash at the outset of the transaction. In effect, each has borrowed from the other, so they have exchanged borrowings.

8. What are the two major kinds of swap facilitators? What is the key difference between the roles they play?

They are swap brokers and swap bankers (swap dealers). The swap broker helps complete a swap by bringing counterparties together and perhaps by providing consulting services. The swap broker does not take a financial position in the transaction. By contrast, a swap banker or swap dealer will take a financial position to help the two parties complete their transaction. As the swap market has developed, the swap dealer has come to predominate. Most swap facilitators today are swap dealers who willingly act as counterparties to swaps.

9. In the context of interest rate swaps, "basis risk" is the risk arising from an unanticipated change in the yield relationship between the two instruments involved in the swap. Explain how basis risk affects a swap dealer. Does it affect a swap broker the same way? Explain.

Basis risk affects a swap dealer because it changes the gross profit margin that the dealer will receive. For example, assume that a swap dealer agrees to pay LIBOR and receive the two-year T-note rate plus 60 basis points. This agreement is based upon the yield spread between LIBOR and the two-year T-note when the swap is initiated. This spread can change due to shifts in the term structure, but it can also change due to political disturbances or other causes. Basis risk arises from changes of the second kind. For example, political unrest in Europe might cause LIBOR to rise relative to US Treasury rates. In our example, the dealer would have to pay a higher rate without receiving any correlatively higher rate. This problem does not affect the swap broker, because the swap broker does not take a risk position in the transaction.

10. Assume a swap dealer attempts to function as a pure financial intermediary avoiding all interest rate risk. Explain how such a dealer may yet come to bear interest rate risk.

Ideally, a pure financial intermediary would take no risk position in the transactions it helps to consummate. In the real world, however, there are few things that are pure. A swap dealer might wish to avoid all risk positions, but swap dealers enter many transactions that are likely to leave the dealer with an unbalanced portfolio and an exposure to interest rate risk. Thus, even risk-averse swap dealers often find themselves with undesired risk positions that must be hedged away.

11. Two parties enter an interest rate swap paid in arrears on the following terms: a seven-year tenor, annual payments, $100 million notional principal, a fixed rate of 6.75 percent, with LIBOR as the floating rate. Assume that the following LIBOR spot rates are observed at each of the following dates. From the perspective of the receive-fixed side of the deal, what is the cash flow at each payment date of the swap? What role does the swap rate observed at the termination of the swap (year 7) play in the analysis?

Year (Date of Observation)	One-Year LIBOR (Rate Actually Observed)	Receive Fixed Cash Flow
0	0.0680	$0
1	0.0575	$6,750,000 − $6,800,000 = −$50,000
2	0.0875	$6,750,000 − $5,750,000 = $1,000,000
3	0.0674	$6,750,000 − $8,750,000 = − $2,000,000
4	0.0600	$6,750,000 − $6,740,000 = $10,000
5	0.0700	$6,750,000 − $6,000,000 = $750,000
6	0.0655	$6,750,000 − $7,000,000 = − $250,000
7	0.0685	$6,750,000 − $6,550,000 = $200,000

The observation of LIBOR at year 7 when the swap terminates plays no role in the analysis of the swap, as it affects no payment. This is the case, because each floating payment on the swap is "determined in advance and paid in arrears."

12. A plain vanilla foreign currency swap has just been arranged between parties ABC and XYZ. ABC has agreed to pay dollars based on LIBOR, while XYZ will pay British pounds at a fixed rate of 7 percent. The current exchange rate is £1 = $1.65. The notional principal is £100 million = $165 million. The tenor of the swap is seven years, and the swap has annual payments paid in arrears. Complete the following table showing the **periodic** cash outflows only for each party at each relevant period of the swap. (Ignore the exchange of principal.)

Year of Observation	LIBOR Rate Observed (%)	XYZ Sterling Pay Outflows	ABC Dollar Pay Outflows
0	6.5800	0	0
1	5.870	£7,000,000	0.0658 × $165,000,000 = $10,857,000
2	6.745	£7,000,000	0.0587 × $165,000,000 = $9,685,500
3	6.550	£7,000,000	0.06745 × $165,000,000 = $11,129,250
4	6.100	£7,000,000	0.0655 × $165,000,000 = $10,807,500
5	6.800	£7,000,000	0.0610 × $165,000,000 = $10,065,000
6	6.350	£7,000,000	0.0680 × $165,000,000 = $11,220,000
7	6.450	£7,000,000	0.0635 × $165,000,000 = $10,477,500

13. A swap dealer holds the following portfolio of interest rate swaps, all with annual payments, all with floating payments equal to LIBOR.

Swap	Notional Principal ($ million)	Tenor (years)	Fixed Rate (%)	Dealer's Position
A	20	3	7.000	Receive-Fixed
B	30	5	6.500	Pay-Fixed
C	25	4	7.250	Pay-Fixed
D	50	7	7.300	Receive-Fixed
E	10	2	6.750	Receive-Fixed

A. Complete the following table showing the dealer's position for each payment in each year. For example, the entry for a given year t and a given swap with a fixed rate of 8 percent, and a notional principal of $15 million, would be of the form: $(LIBOR_{t-1} - 8.00) \times \$15,000,000$.

The Swap Dealer's Anticipated Cash Flows

Year	Swap A	Swap B	Swap C	Swap D	Swap E	Dealer's Net Position
1	$1,400,000 $- LIBOR_0 \times \$20,000,000$	$-\$1,950,000$ $+ LIBOR_0 \times \$30,000,000$	$-\$1,812,500$ $+ LIBOR_0 \times \$25,000,000$	$3,650,000 $- LIBOR_0 \times \$50,000,000$	$675,000 $- LIBOR_0 \times \$10,000,000$	$1,962,500 $- LIBOR_0 \times \$25,000,000$
2	$1,400,000 $- LIBOR_1 \times \$20,000,000$	$-\$1,950,000$ $+ LIBOR_1 \times \$30,000,000$	$-\$1,812,500$ $+ LIBOR_1 \times \$25,000,000$	$3,650,000 $- LIBOR_1 \times \$50,000,000$	$675,000 $- LIBOR_1 \times \$10,000,000$	$1,962,500 $- LIBOR_1 \times \$25,000,000$
3	$1,400,000 $- LIBOR_2 \times \$20,000,000$	$-\$1,950,000$ $+ LIBOR_2 \times \$30,000,000$	$-\$1,812,500$ $+ LIBOR_2 \times \$25,000,000$	$3,650,000 $- LIBOR_2 \times \$50,000,000$	0	$1,287,500 $- LIBOR_2 \times \$15,000,000$
4	0	$-\$1,950,000$ $+ LIBOR_3 \times \$30,000,000$	$-\$1,812,500$ $+ LIBOR_3 \times \$25,000,000$	$3,650,000 $- LIBOR_3 \times \$50,000,000$	0	$-\$112,500$ $+ LIBOR_3 \times \$5,000,000$
5	0	$-\$1,950,000$ $+ LIBOR_4 \times \$30,000,000$	0	$3,650,000 $- LIBOR_4 \times \$50,000,000$	0	$1,700,000 $- LIBOR_4 \times \$20,000,000$
6	0	0	0	$3,650,000 $- LIBOR_5 \times \$50,000,000$	0	$3,650,000 $- LIBOR_5 \times \$50,000,000$
7	0	0	0	$3,650,000 $- LIBOR_6 \times \$50,000,000$	0	$3,650,000 $- LIBOR_6 \times \$50,000,000$

B. Appraise the dealer's net risk position.

Across the years, the dealer's current position appears to be weighted toward the receive-fixed side of the swap market. But the dealer's ultimate exposure depends on the LIBOR rates that materialize. For example, in year 1, a $LIBOR_0$ higher than (about) 8 percent gives a net outflow for the year. If LIBOR rates are in the range of the dealer's fixed rate commitments (6.5 to 7.3 percent), then the dealer's position is weighted toward the receive-fixed side of the deal. The major risk facing the dealer is rising LIBOR rates.

C. Recommend transactions that the dealer might use to reduce the net risk.

The dealer needs to protect against rising short-term rates, particularly in the more distant horizon. In the ordinary conduct of swap dealing, the dealer could reduce exposure by acting as the pay-fixed counterparty. This would be particularly desirable for swaps with a tenor of 6–7 years. The dealer might also consider using Eurodollar futures to hedge some of the risk. For example, by selling Eurodollar futures with expirations that match the existing cash flows, the dealer could reduce interest rate risk. Note that any such effort would only protect against rate changes that arise in the future. To fully appraise the risk exposure of this dealer, it would be helpful to know the current term structure.

14. Consider the swap indication schedule shown in the table below. Two parties, A and B, arrange a plain vanilla interest rate swap with the Bank as intermediary. In effect, A and B are counterparties to each other as described below, but their individual swaps are actually negotiated with the Bank. Party A enters a receive-fixed plain vanilla swap, while Party B enters a pay-fixed plain vanilla swap. Both swaps have a notional principal of $50 million and a five-year tenor. Both swaps have annual payments made in arrears.

| | Sample Swap Indication Pricing Bank's Fixed Rates: (T-Note Rate Plus Indicated Basis Points) | | |
Maturity (years)	Bank Pays	Bank Receives	T-Note Yields (%)
1	23	27	5.74
2	29	33	5.67
3	33	37	5.60
4	37	40	5.55
5	40	44	5.49

A. For each of the parties, state exactly the commitment that they undertake in their swap agreements.

Party A will receive a fixed rate of the 5-year T-Note rate plus 40 basis points, which equals 5.89 percent of a $50 million notional principal. Thus, the fixed inflow will be $2,945,000 each year. In return, Party A will pay (in arrears) LIBOR × $50,000,000. Party B will pay a fixed rate equal to the T-Note yield of 5.49 percent plus 44 basis points, which equals 5.93 percent of a $50 million notional principal. This fixed payment will be $2,965,000 each year. In return, Party B will receive (in arrears) LIBOR × $50,000,000.

B. What net cash flows will the Bank anticipate at each relevant date? What interest rate risk does the Bank face?

For each year t, the net cash flow for the bank will be:

$$\$2,965,000 - \$2,945,000 + LIBOR_{t-1} \times \$50,000,000 - LIBOR_{t-1} \times \$50,000,000 = \$20,000$$

Based on these two deals, the bank does not face interest rate risk.

C. In the event of default by either party, analyze the interest rate risk position of the Bank.

Default by either party exposes the bank to interest rate risk. If Party A, the receive-fixed counterparty to the bank, defaults, the bank is left to honor its commitments to Party B. This means that the bank must receive-fixed/pay-floating, so the bank is exposed to rising interest rates. If Party B defaults, the bank is left only with its pay-fixed/receive-floating obligations to Party A. If Party B defaults, the bank is exposed to interest rate risk from falling rates.

15. What is the difference between a seasonal and a roller coaster swap?

   In a seasonal swap, the notional principal varies according to a fixed plan, typically rising and falling according to a regular plan. In a roller coaster swap, the notional principal of the swap first increases and then amortizes to zero over the remaining life of the swap.

16. Compare and contrast an accreting and an amortizing swap.

   In an amortizing swap, the notional principal is reduced over time, while the notional principal in an accreting swap increases over time. Generally, these changes in notional principal occur on a schedule established when the swap agreement is negotiated.

17. "An equity swap is nothing but a commodity swap." Do you agree or disagree with this statement? Explain.

   In essence, the statement is correct. A commodity swap involves one party making payments that are fixed relative to the price of a commodity and the other party making payments that float with the value of the underlying commodity. In an equity swap, the agreement has the same structure, except the underlying commodity may be thought of as a stock index or a stock portfolio.

18. Consider two plain vanilla interest rate swaps that have the same notional principal, the same fixed rate, and the same initial floating rate. One swap has a tenor of five years, while the second has a tenor of ten years. Assume that you take a pay-fixed position in the ten-year swap and a receive-fixed position in the five-year swap. What kind of instrument do these transactions create? Explain, assuming that the term structure is flat. What difference would it make if the term structure were not flat?

   The net payment from these swaps during the first five years is zero, because the two exactly cancel each other. In each period, the pay-fixed swap requires a fixed payment and a floating receipt. By contrast, the receive-fixed swap generates a fixed receipt and a floating payment. The fixed payments are the same, and the floating payments are the same during the first five years. The pair of swaps, therefore, generates no cash flows in the first five years. After the tenor of the five-year swap, a five-year pay-fixed swap remains. Therefore, from the point of view of the initial contracting, the pair of swaps is equivalent to a forward pay-fixed swap with a tenor of five years that is to be initiated in five years. Notice that this outcome results from the fact that the yield curve is flat, as evidenced by the same fixed rate on two swaps with different tenors. If the term structure were not flat, at least one of the swaps would be an off-market swap, since they both have the same fixed rate. Therefore, you would have to make or receive an up-front payment on each swap that was an off-market swap.

19. "A swaption is essentially a portfolio of options on futures or options on forwards." Is this statement correct? Explain.

   This is false. A swaption is a single option on a swap agreement, not a portfolio of options. The swaption may also be regarded as a single option on a portfolio of forward contracts. However, the swap agreement may be viewed as a portfolio of forward contracts.

20. Generally, political unrest in Europe is accompanied by an increase in the yield differential between Eurocurrency deposit rates and US T-bill rates. Explain how to construct a basis swap to profit from such a development. Explain how this might be related to a TED spread in futures.

   In a basis swap, both parties make floating rate payments, but the payments are tied to different indexes. Thus, to exploit generally unexpected political turmoil in Europe, one might agree to pay based on US T-bill rates and to receive based on Eurocurrency deposit rates. In a TED spread in the futures market, one trades a T-bill futures contract against a Eurodollar futures contract. In this specific case, a trader would sell the Eurodollar futures and buy the T-bill futures to exploit a widening yield differential. This kind of swap is also known as a cross-currency basis swap when the Eurocurrency is not a Eurodollar.

21. Using interest rate swaps based on US Treasury instruments, explain how to create a yield curve swap that will profit if the yield curve has an upward slope and the curve steepens. Explain how this might be related to the NOB spread in futures.

To profit from steepening yield curve, a trader could agree to receive floating payments based on the yield of a long-term instrument (such as a T-bond) and to make floating payments based on the yield of a short-term instrument (such as a T-bill). If the yield curve steepens, the rate received, the long-term rate, will rise more than the rate being paid, the short-term rate. In the NOB trade in the futures market, a trader trades a T-note futures contract against a T-bond futures contract. Thus, to profit from a steepening yield curve, the trader would sell T-bond futures and buy T-note futures. (The NOB trade is discussed in Chapter 5.)

22. Explain how two fixed-for-floating foreign currency swaps might be combined to create a fixed-for-fixed foreign currency swap.

Two fixed-for-floating currency swaps can be combined to created a fixed-for-fixed swap. Assume that in one swap a firm pays floating payments in Currency A and receives fixed payments in Currency B. The firm also has a second swap in which it makes fixed payments in Currency C and receives floating payments in Currency A. Assuming that these two swaps have the same notional amount, the payments in Currency A offset each other. This leaves the firm receiving fixed payments in Currency B and making fixed payments in Currency A.

23.   What is mismatch risk? Why is mismatch risk an important concern of swap dealers?

Mismatch risk refers to the risk that the swap dealer will be left with a position that he cannot offset easily through another swap. This arises if there is a mismatch in the needs between the swap dealer and other participants. The swap dealer=s transactions with multiple counterparties can leave the swap dealer with a residual risk position due to the mismatch between the needs of the counterparties.