

Solution to Questions - Chapter 20
The Secondary Mortgage Market: CMOs and Derivative Securities

Question 20-1

What is a mortgage pay-through bond (MPTB)? How does it resemble a mortgage-backed bond (MBB)? How does it differ?

MPTBs are issued against mortgage pools and, like MPTs, cash flows from the pool are passed through to security holders. However, unlike an MPT, this security is a bond and not an undivided equity ownership interest in a mortgage pool. Like the MBB, the MPTB is a debt obligation of the issuer, who retains ownership of the mortgage pool.

Question 20-2

Are the overcollateralization requirements the same for mortgage pay-through bonds as for the mortgage-backed bonds?

Most pay-through issues are based on residential pools and, like MBBs, will generally be overcollateralized with (1) more mortgages in the pool than the sum of the securities issued against it or (2) additional collateral in the form of U.S. government bonds or other agency obligations.

Question 20-3

Name two different ways that MPTBs can be overcollateralized.

They are overcollateralized in two ways: (1) more mortgages in the pool than the sum of the securities issued against it or (2) additional collateral in the form of U.S. government bonds or other agency obligations.

Question 20-4

What is a CMO? Explain why a CMO has been called as much of a marketing innovation as a financial innovation.

A CMO is a type of mortgage-backed security where a pool of mortgages is used as collateral for several different classes of securities. Each class has different investment characteristics which would appeal to different types of investors. The CMO is a marketing innovation as well as a financial innovation because the different classes of securities can be marketed to a variety of investors with different investment goals.

Question 20-5

What is meant by a derivative investment?

A derivative security derives its value from another security, index, or financial claim. Because the value of mortgage-backed securities (MBS), such as MPTs and CMOs, are based on pools of mortgages, both are referred to as derivatives. IOs and POs are also examples of derivatives.

Question 20-6

Name the four major classes of mortgage-related securities. As an issuer, explain the reasons for choosing one type over another.

The four major classes of mortgage-backed securities are mortgage-backed bonds (MBBs), mortgage pass-through securities (MPTs), mortgage pay-through bonds (MPTBs) and collateralized mortgage obligations (CMOs). The issuer may choose one type over another due to differences in the amount of risk that might be incurred. For example, the issuer retains the prepayment risk on MBBs, whereas the investors incur this risk with MPTs. Also, the issuer may find that there is more of a market for one type of mortgage securities versus another at any given time.

Question 20-7

What is the major difference between a CMO and the other types of mortgage-related securities?

CMOs differ because there are different classes or tranches of securities that are issued. The classes vary in terms of their priority of receipt of principal and interest, including prepayment; they hence differ in terms of maturity and risk.

Question 20-8

Why are CMOs overcollateralized?

CMOs are overcollateralized to provide additional interest income as a cushion to meet contractual payments on the securities. This cushion is especially important when a decrease in interest rates leads to accelerated prepayment. Mortgages that pay the highest interest rates are prepaid first, whereas securities with the lowest coupon (i.e., the class A) receive additional principal from prepayment.

Question 20-9

What is the purpose of the accrual tranche? Could a CMO exist without a Z class? What would be the difference between the CMO with and without the accrual class?

The purpose of the accrual tranche is to provide additional cash flow to shorten the maturity of the higher priority tranches. That is, the interest not going to the Z tranche is used as additional principal for the A tranche until it is completely repaid, then the B tranche until it is repaid, etc.

Question 20-10

Which tranches in a CMO issue are least subject to price variances related to changes in market interest rates? Why?

Changes in market interest rates affect the market value of a tranche. Tranches with the greatest duration (time-weighted maturity) are affected most by changes in interest rates. This will be the lowest priority tranches, e.g., the C tranche has a longer duration than the A tranche. Note that even though a change in interest rates may have a greater impact on the duration of the A tranche than the C tranche, the C tranche still has a longer duration, which is what affects a security's sensitivity to changes in interest rates.

Question 20-11

What is the primary distinction between mortgage-related securities backed by residential mortgages and those backed by commercial mortgages?

The key risk with residential mortgage-related securities is prepayment. Default risk is eliminated when the securities are backed by a federal agency. Commercial mortgages on the other hand are not backed by any federal agencies and therefore default risk must be incurred by investors. Prepayment risk is generally not as significant with commercial mortgage backed securities because these loans typically have significant prepayment penalties and "lock-out" provisions.

Question 20-12

Name the major types of credit enhancement used for commercial-backed mortgage securities.

Forms of credit enhancement include issuer or third-party guarantees, surety bonds and letters of credit, advance payment agreements, loan substitutions and repurchase agreements, lease assignments, over collateralization, and cross-collateralization and cross default. Credit also can be enhanced with commercial mortgage-backed securities through the CMO structure. In this case, the lower priority classes incur any losses from default before the higher classes.

Question 20-13

What are "floater" and "inverse-floater" tranches in a CMO offering?

A floater is a CMO tranche that has a variable interest rate. It is supported by an inverse-floater that is structured so that the sum of interest on the floater and inverse floater sum to a fixed interest amount.

Question 20-14

What is the role of the "scaler" in structuring an (F) and (IF) structure?

A scaler is used to adjust the ratio of the relative composition of interest to be received by the F (floater) and IF (inverse floater) tranches.

Question 20-15

Why would anyone want to purchase an (F) or (IF) derivative type of investment?

Investors may have different expectations about the change in interest rates. Purchasers of a floater may expect rates to rise and purchasers of an inverse floater may expect rates to fall. An inverse floater also can be used by lenders to hedge a portfolio of adjustable rate mortgage loans that they hold.

Question 20-16

What are (IO) and (PO) strips? Which tends to be more volatile in price? Why?

An IO strip receives only the interest from a pool of mortgages. A PO strip receives only the principal. An IO tends to be more volatile because it only receives interest from mortgages that have not been prepaid. Prepayment causes investors in a PO to get repaid sooner, but they still receive all of the principal from the entire pool of mortgages.

Question 20-17

In what ways is a CMBS structure different from a CMO backed by residential mortgages? Why is default risk in a CMBS offering given more attention?

A CMBS is subject to default risk because there are no government agencies that insure the mortgages against default or guarantee the payments as in the case of a CMO backed by residential mortgages. Default risk is borne first by the lower rated tranches in the CMBS. Because there are typically prepayment penalties and “lockout” provisions associated with commercial mortgages, prepayment risk is not a significant concern for CMBS.

Question 20-18

How do CDOs differ from CMBS?

Difference between CDO and CMBS is that CMBS is a subset of CDO. In CMBS the underlying assets are commercial based mortgages but in CDO the underlying asset can be Real Estate ABS, Non-Real Estate ABS, Leveraged Loans, Middle Market Leveraged Loans, Trust preferred securities, CMBS or any combination of these asset classes. So CDO adds another level of complexity to the securitization process.

Solution to Problems - Chapter 20
The Secondary Mortgage Market: CMOs and Derivative Securities

Problem 20-1

(a) The Initial WAC is simply the coupon rate of each tranche weighted by the initial tranche balance

<u>Tranche</u>	<u>Balance</u>	<u>Weighting</u>	<u>Coupon Rate</u>	<u>Weighted Avg Coupon</u>
A	40,500,000	37.50%	8.25%	3.09%
B	22,500,000	20.83%	9.00%	1.87%
Z	45,000,000	41.67%	10.00%	4.17%
Total	\$108,000,000			WAC = 9.13%

(b) To calculate the maturity of each tranche, the yearly interest and principal paid on each tranche must be calculated. Remember that the interest that would have been paid on the Z tranche is applied first to pay down the principal on the A tranche. The Z tranche accrues interest which is added to its principal until all preceding tranches are paid off. The format for this portion of the solution comes directly from Exhibit 18-2.

Mortgage Pool

<u>Year</u>	<u>Beg. Bal</u>	<u>Payment</u>	<u>Interest</u>	<u>Principal</u>	<u>End Bal</u>
1	\$112,500.00	\$18,308.86	11,250.00	\$7,058.86	\$105,441.14
2	105,441.14	\$18,308.86	10,544.11	\$7,764.74	\$97,676.40
3	97,676.40	\$18,308.86	9,767.64	\$8,541.22	\$89,135.18
4	89,135.18	\$18,308.86	8,913.52	\$9,395.34	\$79,739.85
5	79,739.85	\$18,308.86	7,973.98	\$10,334.87	\$69,404.97
6	69,404.97	\$18,308.86	6,940.50	\$11,368.36	\$58,036.61
7	58,036.61	\$18,308.86	5,803.66	\$12,505.20	\$45,531.42
8	45,531.42	\$18,308.86	4,553.14	\$13,755.72	\$31,775.70
9	31,775.70	\$18,308.86	3,177.57	\$15,131.29	\$16,644.42
10	16,644.42	\$18,308.86	1,664.44	\$16,644.42	\$0.00

Tranche A

Amount	\$40,500
Rate	8.25%

<u>Year</u>	<u>Beg. Bal</u>	<u>Interest</u>	<u>Principal</u>	<u>End Bal</u>
1	\$40,500.00	3,341.25	\$11,558.86	\$28,941.14
2	28,941.14	2,387.64	12,714.74	16,226.40
3	16,226.40	1,338.68	13,986.22	2,240.18
4	2,240.18	184.82	2,240.18	0.00
5	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00

Tranche B

Amount	\$22,500
Rate	9.00%

Year	<u>Beg. Bal</u>	<u>Interest</u>	<u>Principal</u>	<u>End Bal</u>
1	\$22,500.00	\$2,025.00	\$0.00	\$22,500.00
2	22,500.00	2,025.00	0.00	22,500.00
3	22,500.00	2,025.00	0.00	22,500.00
4	22,500.00	2,025.00	13,144.65	9,355.35
5	9,355.35	841.98	9,355.35	0.00
6	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00

(c) The weighted average coupon each year is found by weighting the coupon rate for each class by the outstanding balance of that class.

	A	B	Z	Total	WAC
Coupon	8.25%	9.00%	10.00%		
End of Year	Balance	Balance	Balance	Balance	
0	40500	22500	45000	108000	9.14%
1	28941	22500	49500	100941	9.28%
2	16226	22500	54450	93176	9.45%
3	2240	22500	59895	84635	9.69%
4	0	9355	65885	75240	9.88%
5	0	0	64905	64905	10.00%
6	0	0	53537	53537	10.00%
7	0	0	41031	41031	10.00%
8	0	0	27276	27276	10.00%
9	0	0	12144	12144	10.00%

(d)

Tranche a

<u>Year</u>	<u>Beg. Bal</u>	<u>Interest</u>	<u>Principal</u>	<u>End Bal</u>	<u>Cash Flow</u>
1	\$40,500.00	3,341.25	\$11,558.86	\$28,941.14	14,900.11
2	28,941.14	2,387.64	12,714.74	16,226.40	15,102.39
3	16,226.40	1,338.68	13,986.22	2,240.18	15,324.89
4	2,240.18	184.82	2,240.18	0.00	2,425.00
5	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00
P V at				8.50%	\$40,309

Tranche B

<u>Year</u>	<u>Beg. Bal</u>	<u>Interest</u>	<u>Principal</u>	<u>End Bal</u>	<u>Cash Flow</u>
1	\$22,500.00	\$2,025.00	\$0.00	\$22,500.00	2,025.00
2	22,500.00	2,025.00	0.00	22,500.00	2,025.00
3	22,500.00	2,025.00	0.00	22,500.00	2,025.00
4	22,500.00	2,025.00	13,144.65	9,355.35	15,169.65
5	9,355.35	841.98	9,355.35	0.00	10,197.33
6	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00
P V at				9.50%	\$22,110

Tranche Z

<u>Year</u>	<u>Beg. Bal</u>	<u>Interest</u>	<u>Total Payment</u>	<u>End Bal</u>	<u>Cash Flow</u>
0					(\$45,000)
1	\$45,000.00	4,500.00	0.00	\$49,500.00	0.00
2	49,500.00	4,950.00	0.00	54,450.00	0.00
3	54,450.00	5,445.00	0.00	59,895.00	0.00
4	59,895.00	5,989.50	0.00	65,884.50	0.00
5	65,884.50	6,588.45	7,567.98	64,904.97	7,567.98
6	64,904.97	6,490.50	17,858.86	53,536.61	17,858.86
7	53,536.61	5,353.66	17,858.86	41,031.42	17,858.86
8	41,031.42	4,103.14	17,858.86	27,275.70	17,858.86
9	27,275.70	2,727.57	17,858.86	12,144.42	17,858.86
10	12,144.42	1,214.44	13,358.86	0.00	13,358.86
IRR					10.00%
P V at					9.75%
					\$45,768

(e)

Residual Class

<u>Year</u>	<u>Total in pool</u>	<u>Other Classes</u>	<u>Residual</u>
0			(\$4,500.00)
1	\$18,308.86	\$16,925.11	1,383.75
2	\$18,308.86	17,127.39	1,181.47
3	\$18,308.86	17,349.89	958.96
4	\$18,308.86	17,594.65	714.20
5	\$18,308.86	17,765.30	543.55
6	\$18,308.86	17,858.86	450.00
7	\$18,308.86	17,858.86	450.00
8	\$18,308.86	17,858.86	450.00
9	\$18,308.86	17,858.86	450.00
10	\$18,308.86	13,358.86	4,950.00
IRR			19.10%

(f)

Assuming 10% prepayment

Mortgage Pool

<u>Year</u>	<u>Beg. Bal</u>	<u>Payment</u>	<u>Interest</u>	<u>Principal</u>	<u>End Bal</u>	<u>Prepayment</u>
1	\$112,500.00	\$18,308.86	11,250.00	\$18,308.86	\$94,191.14	11250.00
2	94,191.14	\$16,355.40	9,419.11	\$16,355.40	\$77,835.74	9419.11
3	77,835.74	\$14,589.84	7,783.57	\$14,589.84	\$63,245.90	7783.57
4	63,245.90	\$12,991.06	6,324.59	\$12,991.06	\$50,254.84	6324.59
5	50,254.84	\$11,538.88	5,025.48	\$11,538.88	\$38,715.96	5025.48
6	38,715.96	\$10,213.17	3,871.60	\$10,213.17	\$28,502.79	3871.60
7	28,502.79	\$8,991.80	2,850.28	\$8,991.80	\$19,510.99	2850.28
8	19,510.99	\$7,845.66	1,951.10	\$7,845.66	\$11,665.33	1951.10
9	11,665.33	\$6,721.45	1,166.53	\$6,721.45	\$4,943.88	1166.53
10	4,943.88	\$5,438.27	494.39	\$4,943.88	\$0.00	494.39

Tranche A

<u>Year</u>	<u>Beg. Bal</u>	<u>Interest</u>	<u>Principal</u>	<u>End Bal</u>	<u>Cash Flow</u>
1	\$40,500.00	3,341.25	\$22,808.86	\$17,691.14	26,150.11
2	17,691.14	1,459.52	17,691.14	0.00	19,150.66
3	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00

P V at 8.50% \$40,369

Tranche B

Year	<u>Beg. Bal</u>	<u>Interest</u>	<u>Principal</u>	<u>End Bal</u>	Cash <u>Flow</u>
1	\$22,500.00	\$2,025.00	\$0.00	\$22,500.00	2,025.00
2	22,500.00	2,025.00	3,614.26	18,885.74	5,639.26
3	18,885.74	1,699.72	18,885.74	0.00	20,585.46
4	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00
P V at				9.50%	\$22,232

Tranche Z

Year	<u>Beg. Bal</u>	<u>Interest</u>	Total <u>Payment</u>	<u>End Bal</u>	Cash <u>Flow</u>
0					(\$45,000)
1	\$45,000.00	4,500.00	0.00	\$49,500.00	0.00
2	49,500.00	4,950.00	0.00	54,450.00	0.00
3	54,450.00	5,445.00	1,149.10	58,745.90	1,149.10
4	58,745.90	5,874.59	18,865.65	45,754.84	18,865.65
5	45,754.84	4,575.48	16,114.37	34,215.96	16,114.37
6	34,215.96	3,421.60	13,634.77	24,002.79	13,634.77
7	24,002.79	2,400.28	11,392.08	15,010.99	11,392.08
8	15,010.99	1,501.10	9,346.76	7,165.33	9,346.76
9	7,165.33	716.53	7,437.99	443.88	7,437.99
10	443.88	44.39	488.27	0.00	488.27
				IRR	10.00%
P V at				9.75%	\$45,588

Residual

<u>Year</u>	<u>Total in pool</u>	<u>Other Classes</u>	<u>Residual</u>
0			(\$4,500.00)
1	\$29,558.86	\$28,175.11	1,383.75
2	\$25,774.52	24,789.92	984.60
3	\$22,373.42	21,734.56	638.86
4	\$19,315.65	18,865.65	450.00
5	\$16,564.37	16,114.37	450.00
6	\$14,084.77	13,634.77	450.00
7	\$11,842.08	11,392.08	450.00
8	\$9,796.76	9,346.76	450.00
9	\$7,887.99	7,437.99	450.00
10	\$5,438.27	488.27	4,950.00

IRR 16.10%

(g)

10 percent price increase after issue**Tranche A**

<u>Year</u>	<u>Beg. Bal</u>	<u>Interest</u>	<u>Principal</u>	<u>End Bal</u>	<u>Cash Flow</u>	<u>10% Price Increase</u>
0						(\$44,550)
1	\$40,500.00	3,341.25	\$22,808.86	\$17,691.14	26,150.11	26,150.11
2	17,691.14	1,459.52	17,691.14	0.00	19,150.66	19,150.66
3	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00

P V at 8.50% \$40,369
YTM 1.18%

Tranche B

Year	<u>Beg. Bal</u>	<u>Interest</u>	<u>Principal</u>	<u>End Bal</u>	Cash <u>Flow</u>	<u>10% Price Increase</u>
0						(\$24,750)
1	\$22,500.00	\$2,025.00	\$0.00	\$22,500.00	2,025.00	2,025.00
2	22,500.00	2,025.00	3,614.26	18,885.74	5,639.26	5,639.26
3	18,885.74	1,699.72	18,885.74	0.00	20,585.46	20,585.46
4	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00
P V at				9.50%	\$22,232	
					YTM	5.12%

Class Z

Year	<u>Beg. Bal</u>	<u>Interest</u>	<u>Total Payment</u>	<u>End Bal</u>	Cash <u>Flow</u>	<u>10% Price Increase</u>
0					(\$45,000)	(\$49,500)
1	\$45,000.00	4,500.00	0.00	\$49,500.00	0.00	0.00
2	49,500.00	4,950.00	0.00	54,450.00	0.00	0.00
3	54,450.00	5,445.00	1,149.10	58,745.90	1,149.10	1,149.10
4	58,745.90	5,874.59	18,865.65	45,754.84	18,865.65	18,865.65
5	45,754.84	4,575.48	16,114.37	34,215.96	16,114.37	16,114.37
6	34,215.96	3,421.60	13,634.77	24,002.79	13,634.77	13,634.77
7	24,002.79	2,400.28	11,392.08	15,010.99	11,392.08	11,392.08
8	15,010.99	1,501.10	9,346.76	7,165.33	9,346.76	9,346.76
9	7,165.33	716.53	7,437.99	443.88	7,437.99	7,437.99
10	443.88	44.39	488.27	0.00	488.27	488.27
				YTM		8.18%
PV at				9.75%	\$45,588	

Problem 20-2

(a)

Beginning Balance	=	\$1,000,000
Prepayment Rate	=	0.00
Interest Rate	=	0.08

<u>Period</u>	<u>Beginning Balance</u>	<u>Interest IO/Strip</u>	<u>Principal PO/Strip</u>	<u>PO Prepayment</u>	<u>Ending Balance</u>
1	\$1,000,000	\$80,000	\$69,029	\$0	\$930,971
2	930,971	74,478	74,552	0	856,419
3	856,419	68,513	80,516	0	775,903
4	775,903	62,072	86,957	0	688,945
5	688,945	55,116	93,914	0	595,032
6	595,032	47,603	101,427	0	493,605
7	493,605	39,488	109,541	0	384,063
8	384,063	30,725	118,304	0	265,759
9	265,759	21,261	127,769	0	137,990
10	137,990	11,039	137,990	0	0

The price of the IO and PO strips is the PV of the cash flows at 8%

	<u>IO/Strip</u>	<u>PO/Strip</u>
PV/Price at 8%	\$360,838	\$639,162

(b) If interest rates increase to 10% then the price of the IO and PO is the PV of the respective cash flows at 10%

	<u>IO/Strip</u>	<u>PO/Strip</u>
PV/Price at 10%	\$337,113	\$578,608

The percentage change in the IO and PO price is:

	<u>IO/Strip</u>	<u>PO/Strip</u>
% change in price	-6.57%	-9.47%

The PO strip has the greatest change in price which demonstrates it has greater amounts of convexity than the IO

(c) Cash flow schedule at 0% prepayment

Beginning Balance	=	\$1,000,000
Prepayment Rate	=	0.00
Interest Rate	=	0.08

<u>Period</u>	<u>Beginning Balance</u>	<u>Interest IO/Strip</u>	<u>Principal PO/Strip</u>	<u>PO Prepayment</u>	<u>Ending Balance</u>
1	\$1,000,000	\$80,000	\$69,029	\$0	\$930,971
2	930,971	74,478	74,552	0	856,419
3	856,419	68,513	80,516	0	775,903
4	775,903	62,072	86,957	0	688,945
5	688,945	55,116	93,914	0	595,032
6	595,032	47,603	101,427	0	493,605
7	493,605	39,488	109,541	0	384,063
8	384,063	30,725	118,304	0	265,759
9	265,759	21,261	127,769	0	137,990
10	137,990	11,039	137,990	0	0

The price of the 0% prepayment IO and PO strips is the PV of the cash flows at 6%

	<u>IO/Strip</u>	<u>PO/Strip</u>
PV/Price at 6%	\$387,480	\$709,390

Cash flow schedule at 20% prepayment

Beginning Balance	=	\$1,000,000
Prepayment Rate	=	0.20
Interest Rate	=	0.08

<u>Period</u>	<u>Beginning Balance</u>	<u>Interest IO/Strip</u>	<u>Principal PO/Strip</u>	<u>PO Prepayment</u>	<u>Ending Balance</u>
1	\$1,000,000	\$80,000	\$69,029	\$200,000	\$730,971
2	730,971	58,478	58,536	146,194	526,241
3	526,241	42,099	49,474	105,248	371,518
4	371,518	29,721	41,637	74,304	255,578
5	255,578	20,446	34,839	51,116	169,623
6	169,623	13,570	28,913	33,925	106,785
7	106,785	8,543	23,698	21,357	61,730
8	61,730	4,938	19,015	12,346	30,369
9	30,369	2,430	14,601	6,074	9,695
10	9,695	776	9,695	0	0

The price of the 20% prepayment IO and PO strips is the PV of the cash flows at 6%

	<u>IO/Strip</u>	<u>PO/Strip</u>
PV/Price at 6%	\$221,902	\$833,574

Problem 20-3

(a) Scale = 50% / 50% = 1.0

		<u>Scale</u>	<u>Interest Rate</u>	<u>Interest Payable</u>
(F) Floater	\$1,000,000	0.50	0.08	\$80,000
(IF) Inverse Floater	1,000,000	0.50	0.08	<u>80,000</u>
				\$160,000

Maximum cap for (F)
 $(160,000 / 1,000,000) - .08 = 0.080$ increase in the interest rate or an interest rate of 16%

Maximum floor for (IF)
 $(.08) \times 1 = 0.080$ decrease in the interest rate or an interest rate of 0%

(b) Scale = 60% / 40% = 1.5

		<u>Scale</u>	<u>Interest Rate</u>	<u>Interest Payable</u>
(F) Floater	\$1,200,000	0.60	0.08	\$96,000
(IF) Inverse Floater	800,000	0.40	0.08	<u>64,000</u>
				\$160,000

Maximum cap for (F)
 $(160,000 / 1,200,000) - .08 = 0.053$ increase in the interest rate or an interest rate of 13.33%

Maximum floor for (IF)
 $-(.053) \times (1.5) = -0.080$ decrease in the interest rate or an interest rate of 0%

(c) Impact of 2% increase in interest rate under 50% proportions

		<u>Scale</u>	<u>Interest Rate</u>	<u>Interest Payable</u>
(F) Floater	\$1,000,000	0.50	0.10	\$100,000
(IF) Inverse Floater	1,000,000	0.50	0.06	<u>60,000</u>
				\$160,000

F receives \$100,000 and IF receives \$60,000

Impact of 2% increase in interest rate under 60% / 40% proportions

		<u>Scale</u>	<u>Interest Rate</u>	<u>Interest Payable</u>
(F) Floater	\$1,200,000	0.60	0.10	\$120,000
(IF) Inverse Floater	800,000	0.40	0.05	<u>40,000</u>
				\$160,000

F receives \$120,000 and IF receives \$40,000

Impact of 2% decrease in interest rate under 50% proportions

		<u>Scale</u>	<u>Interest Rate</u>	<u>Interest Payable</u>
(F) Floater	\$1,000,000	0.50	0.06	\$60,000
(IF) Inverse Floater	1,000,000	0.50	0.10	<u>100,000</u>
				\$160,000

F receives \$60,000 and IF receives \$100,000

Impact of 2% decrease in interest rate under 60% / 40% proportions

		<u>Scale</u>	<u>Interest Rate</u>	<u>Interest Payable</u>
(F) Floater	\$1,200,000	0.60	0.06	\$72,000
(IF) Inverse Floater	800,000	0.40	0.11	<u>88,000</u>
				\$160,000

F receives \$72,000 and IF receives \$88,000

Summary

		<u>Yield</u>		
	<u>Proportions</u>	<u>of Issue</u>	<u>2% increase in interest rate</u>	<u>2% decrease in interest rate</u>
Case (a)				
(F)	50%	8%	10	6
(IF)	50%	8%	6	10
Case (b)				
(F)	60%	8%	10	6
(IF)	40%	8%	5	11

In case (a) there is an equal impact of changing interest rates on the F and IF yields, that is, each either increases or decreases by 2%. In case (b) however, IF investors will experience greater volatility in yield. This is because the proportion of each class comprising the tranche is now 60 - 40. Therefore, for each 1% change in the underlying interest rate, IF investors will realize a change in yield of 1.5%.

Problem 20-4

See table below:

Prepayment Rate	IRR on Residual
0.00%	19.10%
5.00%	17.33%
10.00%	16.10%
15.00%	15.53%
20.00%	14.99%
25.00%	14.74%
30.00%	14.74%

Problem 20-5

See below:

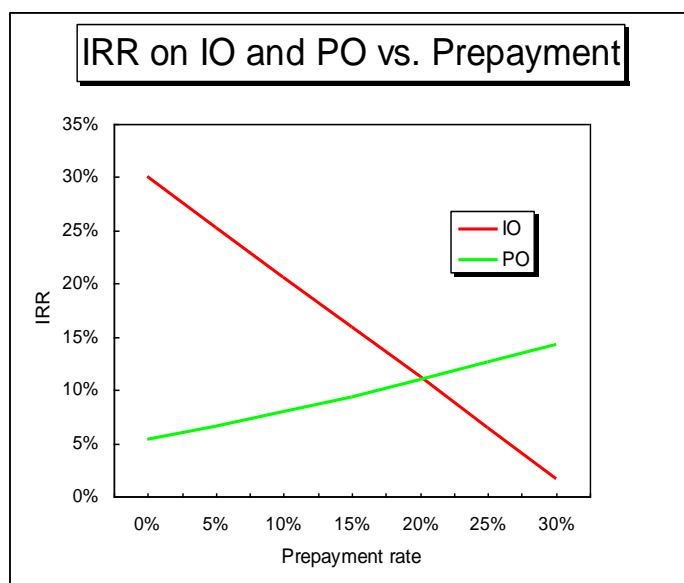
<u>Libor</u>	<u>(F) Rate</u>	<u>(IF) Rate</u>	<u>F interest</u>	<u>IF Interest</u>	<u>Total interest</u>
0%	0.00%	24.00%	\$0	\$1,200,000	\$1,200,000
1%	1.00%	21.00%	150,000	1,050,000	1,200,000
2%	2.00%	18.00%	300,000	900,000	1,200,000
3%	3.00%	15.00%	450,000	750,000	1,200,000
4%	4.00%	12.00%	600,000	600,000	1,200,000
5%	5.00%	9.00%	750,000	450,000	1,200,000
6%	6.00%	6.00%	900,000	300,000	1,200,000
7%	7.00%	3.00%	1,050,000	150,000	1,200,000
8%	8.00%	0.00%	1,200,000	0	1,200,000

Note that the inverse floater now starts at a higher rate with Libor equal to 0% and decreases at a faster rate than before.

Problem 20-6

See below:

Prepayment	IRR of IO	IRR of PO
0.00%	30.00%	5.38%
5.00%	25.32%	6.57%
10.00%	20.62%	7.90%
15.00%	15.91%	9.37%
20.00%	11.19%	10.94%
25.00%	6.45%	12.59%
30.00%	1.70%	14.30%



Problem 20-7

The returns to the subordinated tranche = 11.17%

The returns to the residual = -4.92%

Solutions to Problems - Chapter 20 Appendix

The Secondary Mortgage Market: CMOs and Derivative Securities

Problem 20A-1

(a)

Interest Payments of a Corporate Bond	=	\$10,000
Final Payment of a Corporate Bond	=	\$100,000
Annual Payments of a Mortgage	=	\$16,275
Final Payment of a Mortgage Bond	=	\$61,693

Duration Calculation of a Corporate Bond:

Period	Payment	Weighting Factor	Present Value	Weighted PV of Payment
0				
1	10,000	1.0	0.9091	14,795
2	10,000	2.0	0.8264	26,901
3	10,000	3.0	0.7513	36,693
4	10,000	4.0	0.6830	44,464
5	10,000	5.0	0.6209	50,527
5	100,000	5.0	0.6209	191,532
Total				<u>\$364,903</u>

Duration	=	Total weighted present value of payments
Duration	=	\$364,903 \ \$100,000
Duration	=	3.65 years

(b) New price for corporate bond if interest rate falls from 10% to 7%

Difference	=	10% - 7%	=	3.00%
Duration	=	4.17 years		
% Change in Price	=	-11.37%		
New Price	=	Old Price * (1 + % Change)		
New Price	=	\$88,628		

New price for mortgage bond if interest rate falls from 10% to 7%

Difference	=	10% - 7%	=	3.00%
Duration	=	3.65 years		
% Change in Price	=	-9.95%		
New Price	=	Old Price x (1 + % Change)		
New Price	=	\$90,048		