

**RE 611 / Fin 611 – Real Estate Finance**  
**Spring 2012**

Final Exam – Version A – Suggested Solutions

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*MW 8:00-9:15*

- 1) (20 points) Hermes would like to purchase a temple from Ares, and is considering two different financing options. The first is a \$280,000 30-year fixed-rate mortgage at 7.50 percent interest; the lender would charge him 1.5 points for this loan, which Hermes would pay out of pocket at closing.

Alternatively, Hermes could assume Ares' existing mortgage. This loan has a remaining term of 10 years, an outstanding balance of \$55,000, and an interest rate of 3.5 percent. Hermes could then take out a second mortgage for \$225,000 at 8.0 percent over 30 years. Total closing costs under this option would be \$5,000 (once again, paid out of pocket at closing).

Under either loan option, Hermes expects to hold the loans for 15 years.

Calculate the effective borrowing cost of each option and indicate which Hermes should choose. In addition, calculate the IRR of the differential cash flows between the two options and indicate how Hermes should determine which option to choose.

Option A – Traditional Financing

$$N = 360, P/Y = 12, I = 7.5, PV = 280,000, FV = 0 \Rightarrow PMT = -1,957.80$$

$$N = 180 \Rightarrow FV = -211,194.66$$

$$PV = 280,000 \times (1 - 0.015) = 275,800 \Rightarrow EBC = 7.68\%.$$

Option B – Assume Ares' Loan

$$\text{Assumed loan: } PV = 55,000, N = 120, I = 3.5, FV = 0 \Rightarrow PMT = -543.87$$

$$2^{\text{nd}} \text{ mortgage: } PV = 225,000, N = 360, I = 8.0, FV = 0 \Rightarrow PMT = -1,650.97;$$

$$N = 180 \Rightarrow FV = -172,758.51$$

$$\text{Total: } PV = 55,000 + 225,000 - 5,000 = 275,000, PMT_{1-120} = -543.87 - 1,650.97 = -2,194.84, PMT_{121-180} = -1,650.97, FV = -172,758.51$$

	<u>Assume + 2<sup>nd</sup></u>	<u>Traditional</u>	<u>Difference</u>
PV	275,000.00	275,800.00	-800.00
CF <sub>1-120</sub>	-2,194.84	-1,957.80	-237.04
CF <sub>121-179</sub>	-1,650.97	-1,957.80	306.83
CF <sub>180</sub>	-174,409.48	-213,152.46	38,742.98
EBC/IRR	7.75%	7.68%	6.99%

Based on the EBC's of the two options, the traditional financing is less expensive. The differential cash flows "look like" an investment. Hermes should assume Ares existing loan and take out a second mortgage only if he cannot find another investment that will provide him with more than a 7 percent (risk-adjusted) return on his investment.

- 2) (10 points) Hera's home is currently worth \$385,000, and her outstanding mortgage balance is \$40,000. She is considering taking out a reverse mortgage. Her lender has offered her a 70 percent LTV reverse mortgage at 6.00 percent interest with a 15-year term; Hera will incur closing costs of \$3,000 in association with this loan; these costs will be rolled into the loan.

- a) Based on this information, what is the largest monthly payment Hera can receive from this loan?

The initial principal balance of Hera's new reverse mortgage will be the current balance on her existing mortgage plus the closing costs she incurs:  
 $PV = 40,000 + 3,000 = 43,000$ . This is entered as a positive number, because it represents value that Hera will receive.

The LTV ratio is used to calculate the FV of the loan at the end of 15 years, so enter  $FV = -385,000 \times 0.70 = -269,500$ . This is entered as a negative number because it is the amount that Hera (or her heirs) will have to pay at the end of 15 years.

Finally, enter  $P/Y = 12$ ,  $N = 15 \times 12 = 180$ ,  $I = 6$  and solve for  $PMT = 563.84$ . The positive number here indicates that Hera can *receive* \$563.84 per month from the lender.

- b) How much will Hera owe on this loan at the end of 10 years?

Enter  $N = 10 \times 12 = 120$  and solve for  $FV = -170,635.09$ .

- c) If Hera expects to be in this home for 10 more years, what is her EBC on this loan?

Think about the actual cash flows here. Although her initial loan amount is \$43,000, Hera only received \$40,000 in cash (that she used to pay off her old mortgage); the rest was a fee charged by the new lender. Thus, enter  $PV = 40,000$  and solve for  $I = 6.44\%$ . Notice that the EBC is larger than the nominal interest rate (this is one way to check your answer).

- 3) (20 points) Zeus would like to borrow \$245,000 using a 30-year, 1-year ARM indexed to the 1-year Treasury security with a 2.75 percent margin and 2/6 caps (2 percent per year and 6 percent lifetime). The initial interest rate on this loan is 2.75 percent. His lender, Olympia Mortgage, will charge 1.50 points and \$1,200 in miscellaneous fees to close the loan (which Zeus will pay out of pocket).

- a) What is the initial payment on this mortgage?

$P/Y = 12$ ,  $N = 360$ ,  $I = 2.75$ ,  $PV = 245,000$ ,  $FV = 0 \Rightarrow PMT = -\$1,000.19$ .

- b) If the 1-year Treasury security is yielding 2.25 percent at the first adjustment date, what is Zeus' payment on this loan during the second year?

The lifetime maximum interest rate for this ARM is  $2.75\% + 6.00\% = 8.75\%$ .

The annual maximum for this ARM in the second year is  $2.75\% + 2.00\% = 4.75\%$ .

The fully-indexed rate for this ARM in the second year is  $2.25\% + 2.75\% = 5.00\%$ .

The new contract rate in the second year is 4.75% because the annual cap is binding.

At the end of the first year, the balance outstanding is  $N = 12 \Rightarrow$

$FV = -239,668.34$ . Entering this as the PV and setting  $N = 360 - 12 = 348$ ,

$I = 4.75$ , and  $FV = 0$ , you can solve for  $PMT = -\$1,269.82$ .

- c) Suppose that the 1-year Treasury is yielding 2.75 percent at the second adjustment date. What is the new payment on this loan during the third year?

The annual maximum for the third year is  $4.75\% + 2.00\% = 6.75\%$ .

The fully-indexed rate is  $2.75\% + 2.75\% = 5.50\%$ .

The contract rate for the third year is 5.50%, because neither of the caps is binding.

$N = 12 \Rightarrow FV = -235,729.76$ .

$PV = 235,729.76$ ,  $N = 348 - 12 = 336$ ,  $I = 5.50$ ,  $FV = 0 \Rightarrow$

$PMT = -\$1,376.58$ .

- d) Assuming that Zeus pays off the loan at the end of the third year, what yield will Olympia earn on this loan?

The balance due at the end of the third year is  $N = 12 \Rightarrow FV = -\$232,084.96$ .

Enter the following figures into your irregular cash flow worksheet:

$CF_0 = 245,000 \times (1 - 0.015) - 1,200 = 240,125.00$

$C_01 = -1,000.19$

$F_01 = 12$

$C_02 = -1,269.82$

$F_02 = 12$

$C_03 = -1,376.58$

$F_03 = 11$

$C_04 = -1,376.58 - 232,084.96 = -233,461.54$

$F_04 = 1$

$\Rightarrow IRR = 0.4172 \times 12 = 5.01\%$ .

Multiple Choice / True-False Questions – Two points each

- \_\_\_\_\_ 1. Prior to the Great Depression, most mortgages in the U.S. were
- A. long-term, fully-amortizing loans.
  - B. long-term, interest-only loans.
  - C. short-term, fully-amortizing loans.
  - D. *SHORT-TERM, INTEREST-ONLY LOANS.***
  - E. made by Old Man Potter.
- \_\_\_\_\_ 2. All else equal, the expected yield on a 3-1 ARM will be \_\_\_\_\_ the yield on a 1-year ARM.
- A. the same as
  - B. *HIGHER THAN***
  - C. lower than
- \_\_\_\_\_ 3. Acme Bank just originated a \$200,000, 15-year, fixed-rate mortgage at 5.25 percent interest. The mortgage has an expected life of 10 years. If outside investors require a 5.75 percent return on mortgages, what is the market value of this mortgage?
- A. \$1,706.76
  - B. \$200,000.00
  - C. *\$194,182.86***
  - D. \$84,681.18
  - E. None of the above; the correct answer is \_\_\_\_\_.
- \_\_\_\_\_ 4. If the lender charges up-front fees to originate a loan, the
- A. lender's effective yield will equal the nominal interest rate on the loan.
  - B. *EFFECTIVE BORROWING COST WILL INCREASE AS THE EXPECTED HOLDING PERIOD GETS SHORTER.***
  - C. annual percentage rate will decrease as the expected holding period gets shorter.
  - D. annual percentage rate will always equal the effective borrowing cost.
  - E. lender's effective yield will decrease as the expected holding period gets shorter.
- \_\_\_\_\_ 5. Compared to mortgage pass-through securities, mortgage-backed bonds should be priced to provide
- A. *LOWER YIELDS THAN PASS-THROUGHS BECAUSE OF LOWER PREPAYMENT RISK.***
  - B. higher yields than pass-throughs because of lower prepayment risk.
  - C. lower yields than pass-throughs because of higher prepayment risk.
  - D. higher yields than pass-throughs because of higher prepayment risk.
  - E. the same yields as pass-throughs.

- \_\_\_\_\_ 6. In a collateralized mortgage obligation, the term “toxic waste” refers to
- A. A RESIDUAL CLASS WITH CASH FLOWS THAT ARE HARD TO VALUE.
  - B. an accrual tranche that must wait a long time to receive any cash flows.
  - C. a fast-pay tranche bearing a large amount of prepayment risk.
  - D. an interest-only strip.
  - E. None of the above
- \_\_\_\_\_ 7. Mortgage servicing rights most closely resemble which of the following securities?
- A. Mortgage-backed bonds
  - B. Principal-only strips
  - C. INTEREST-ONLY STRIPS
  - D. Class Z bonds in a collateralized mortgage obligation with a sequential pay structure
  - E. None of the above
- \_\_\_\_\_ 8. When market interest rates fall prepayments \_\_\_\_\_, which tends to \_\_\_\_\_ the value of servicing rights.
- A. SPEED UP, DECREASE
  - B. slow down, decrease
  - C. speed up, increase
  - D. slow down, increase
  - E. None of the above
- \_\_\_\_\_ 9. Prepayment risk is absorbed by the \_\_\_\_\_ with a mortgage backed bond.
- A. investor
  - B. ISSUER
  - C. Neither of the above
- \_\_\_\_\_ 10. Which of the following factors are generally included in statistical models of prepayment patterns? More than one may be correct; write down the letters of ALL correct answers.
- A. THE DIFFERENCE BETWEEN THE INTEREST RATES ON MORTGAGES IN THE POOL AND CURRENT MORTGAGE RATES
  - B. GROWTH IN REAL GROSS DOMESTIC PRODUCT OR EMPLOYMENT
  - C. THE GEOGRAPHIC LOCATION OF THE PROPERTIES BACKING THE MORTGAGES IN THE POOL
  - D. THE SEASONING OF MORTGAGES IN THE POOL
  - E. THE DEMOGRAPHIC CHARACTERISTICS OF THE BORROWERS WITH MORTGAGES IN THE POOL

Use the following information to answer the next three questions:

Consider a pass-through security issued at par and suppose that market interest rates fall immediately after the security is issued.

- \_\_\_\_\_ 11. The discount rate effect will tend to \_\_\_\_\_.  
A. leave the value of the pass-through unchanged  
B. lower the value of the pass-through  
**C. RAISE THE VALUE OF THE PASS-THROUGH**  
D. have an indeterminate effect on the value of the pass-through
- \_\_\_\_\_ 12. The prepayment effect will tend to \_\_\_\_\_.  
A. leave the value of the pass-through unchanged  
**B. LOWER THE VALUE OF THE PASS-THROUGH**  
C. raise the value of the pass-through  
D. have an indeterminate effect on the value of the pass-through
- \_\_\_\_\_ 13. The total effect of this change will \_\_\_\_\_.  
A. leave the value of the pass-through unchanged  
B. lower the value of the pass-through  
**C. RAISE THE VALUE OF THE PASS-THROUGH**  
D. have an indeterminate effect on the value of the pass-through
- \_\_\_\_\_ 14. True or **FALSE**: Fannie Mae does not purchase mortgages. Instead it simply provides guarantees of timely payment of principal and interest on pass-through securities issued by others.
- \_\_\_\_\_ 15. What is the purpose of an assignment of commitment letter?  
A. It allows a mortgage bank to sell loans to Fannie Mae or Freddie Mac.  
**B. IT ALLOWS THE CONSTRUCTION LENDER TO BYPASS THE DEVELOPER AND COLLECT MORTGAGE FUNDS DIRECTLY FROM THE PERMANENT LENDER.**  
C. It requires the borrower to use a specific lender in the future.  
D. It allows Fannie Mae or Freddie Mac to demand payment on past due mortgages.  
E. It allows a borrower to be committed to a psychiatric hospital if his repayment behavior is too erratic.
- \_\_\_\_\_ 16. Which of the following is NOT an important source of funding for commercial mortgages?  
A. Insurance companies  
B. Commercial banks  
C. Mortgage-backed securities conduits  
**D. FREDDIE MAC**  
E. All of the above are important sources of funding for commercial mortgage

- \_\_\_\_\_ 17. If the lender demands “recourse” on a commercial real estate loan it means that
- A. **THE BORROWER WILL BE PERSONALLY RESPONSIBLE FOR REPAYING THE LOAN.**
  - B. the lender is looking only to the property to make the monthly mortgage payments.
  - C. the lender has the right to initiate foreclosure proceedings should the borrower default on the loan.
  - D. the loan will be unsecured.
  - E. None of the above
- \_\_\_\_\_ 18. Five years ago Atlas took out a \$2 million commercial mortgage amortized over 15 years at 7.5 percent interest. Now current market rates are 5.00 percent and Atlas would like to refinance the loan. Unfortunately, the loan has a yield maintenance premium (YMP) clause that is designed to ensure the lender continues to earn a 7.5 percent return if Atlas refinances the loan. How large will this penalty be if he refinances the loan?
- A. \$18,540.25
  - B. \$16,566.57
  - C. \$156,191.84
  - D. **\$186,081.19**
  - E. None of the above; the correct answer is \_\_\_\_\_.
- \_\_\_\_\_ 19. Dionysus would like to purchase a commercial property with a first-year net operating income (NOI) of \$250,000; the proposed purchase price is \$3.5 million. His lender is willing to provide financing at 8 percent interest over 20 years with monthly payments. The lender requires a maximum loan-to-value (LTV) ratio of 70 percent and a minimum debt coverage ratio of 1.30. Based on this information what is the largest loan Dionysus can receive for this property?
- A. \$3,500,000
  - B. \$2,450,000
  - C. **\$1,915,934**
  - D. \$2,049,278
  - E. None of the above; the correct answer is \_\_\_\_\_.
- \_\_\_\_\_ 20. One year ago, Aphrodite took out a \$125,000, 30-year price-level adjusted mortgage (PLAM) with a fixed interest rate of 3.5 percent. If actual inflation over the past year was 5 percent, how much does she owe on this mortgage now (the beginning of the second year)?
- A. \$125,000.00
  - B. \$124,055.05
  - C. \$122,601.09
  - D. **\$128,731.14**
  - E. None of the above; the correct answer is \_\_\_\_\_.

Use the following information to answer the next two questions:

Poseidon is going to buy a new home and has annual income of \$80,000. He has applied for a mortgage that will have a monthly payment of \$1,200. Other expenses include the following:

Hazard insurance	\$1,800 per year
Property taxes	\$4,800 per year
Auto payment	\$575 per month
Monthly utilities	\$350 per month
Credit card loan	\$250 per month
Student loan	\$500 per month

- \_\_\_\_\_ 21. What is Poseidon's front-end ratio on this mortgage?
- A. 18.0 percent
  - B. 31.5 percent
  - C. 26.3 PERCENT**
  - D. 46.1 percent
  - E. None of the above; the correct answer is \_\_\_\_\_.
- \_\_\_\_\_ 22. What is Poseidon's back-end ratio on this mortgage?
- A. 46.1 PERCENT**
  - B. 26.3 percent
  - C. 31.5 percent
  - D. 51.4 percent
  - E. None of the above; the correct answer is \_\_\_\_\_.

Use the following information to answer the next two questions:

Apollo recently took out a \$230,000, 15-year, fixed-rate, constant amortization mortgage (CAM) at 5.75 percent interest with monthly payments.

- \_\_\_\_\_ 23. How large is the total payment Apollo must make in the 45<sup>th</sup> month of this loan?
- A. \$1,277.77
  - B. \$1,909.94
  - C. \$2,110.46**
  - D. \$1,603.21
  - E. None of the above; the correct answer is \_\_\_\_\_.
- \_\_\_\_\_ 24. How much will Apollo owe on this loan at the end of the 7<sup>th</sup> year?
- A. \$107,333.33
  - B. \$122,666.67**
  - C. \$146,692.59
  - D. \$230,000.00
  - E. None of the above; the correct answer is \_\_\_\_\_.



- \_\_\_\_\_ 25. (Bonus) What do all of the names used in this exam have in common?
- A. They are Dr. Longhofer's relatives.
  - B. *THEY ARE ALL NAMES OF GODS FROM GREEK MYTHOLOGY.***
  - C. I liked the Dr. Seuss names better.
  - D. You really have too much time on your hands when you write exams, don't you Dr. L.