

RE 618/890 – Real Estate Investment Analysis
Fall 2001

Midterm Exam #1 – Suggested Solutions

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T-Th 8:00-9:15

You have 1 hour and 15 minutes to complete this exam. I know its long; don't worry, just do the best you can in the time allotted. I would spend a few minutes looking it over before you begin; start with the questions you know best and work on the others last. The number of points for each question is intended to indicate how much time you should spend on each. This weighting incorporates both the time it should take you to answer the question and its relative importance.

I've tried to eliminate any ambiguity about how to interpret the questions on the exam. Nevertheless, if you make any assumptions not explicitly stated in the questions, make sure you write them down so I can see what you are doing.

Finally, *remember to show your work*. I can only give partial credit for incorrect answers if I can tell what you were trying to do.

1) (5 points) Consider an investment with the following cash flows:

n	\$
0	(20,000)
1	1,806
2	1,900
3	(4,000)
4	1,000
5	1,000
6	53,000

a) Calculate the NPV of this project using a 10% discount rate.

Enter the above figures into the cash flow worksheet in a financial calculator to get
 NPV = \$11,428.

b) Calculate the IRR of this project.

Using the same cash flow figures, solve for IRR = 19.07%.

- c) Calculate the MIRR of this project assuming a 10% cost of capital.

The MIRR is calculated by using the cost of capital to discount all negative cash flows back to date 0 and compound all positive cash flows forward to the terminal date.

n	\$
0	(20,000) + (3,005) = (23,005)
1	1,806
2	1,900
3	(4,000)
4	1,000
5	1,000
6	53,000 + 1,100 + 1,210 + 2,782 + 2,909 = 61,001

To solve for the MIRR, enter PV = (23,005), FV = 61,001, P/Y = 1, N = 6, PMT = 0, and solve for I/Y = 17.65%.

- 2) (10 points) Consider a \$2.5 million mortgage with a 7.875% interest rate, a 20-year amortization schedule, monthly payments, and 2.5 points.

- a) What is the monthly debt payment required on this mortgage?

Enter PV = 2,500,000, P/Y = 12, I/Y = 7.875, N = 20 × 12 = 240, FV = 0, and solve for PMT = (20,717).

- b) If the first payment on the mortgage is due on April 1, how much interest will be paid in the first tax year? In the second? Third?

Use the amortization worksheet to solve this problem.

Enter P1 = 1, P2 = 9, and solve for INT = (146,622).

Enter P1 = 10, P2 = 21, and solve for INT = (191,714).

Enter P1 = 22, P2 = 33, and solve for INT = (187,069).

- c) What is the effective borrowing cost on this loan if the expected holding period is 5 years? What is the effective borrowing cost if the expected holding period is 10 years?

5-year holding period

Enter N = 5 × 12 = 60 and solve for FV = (2,184,294).

Enter PV = 2,500,000 × 0.975 = 2,437,500 and solve for I/Y = 8.53%.

10-year holding period

Enter N = 10 × 12 = 120 and solve for FV = (1,716,853).

Enter PV = 2,500,000 × 0.975 = 2,437,500 and solve for I/Y = 8.29%.

- 3) (15 points) You are considering purchasing apartment complex. Current rent rolls indicate the following:

Unit Size	Number of Units	Monthly Rent	Number Occupied
1 BR	25	\$525	23
2 BR	45	\$650	40
3 BR	30	\$700	20

An analysis of the apartment market suggests that these rents are competitive. The average vacancy rate in the market is currently 10 percent.

Operating expenses include \$95,000 in salaries and benefits for employees, \$87,000 in property taxes, and \$44,250 for repairs and maintenance.

The asking price for this property is \$5 million.

- a) Write out the pro forma operating statement for this property based on its current situation. What is the cap rate for this property?

Potential gross income is calculated by multiplying the monthly rent for each unit by the number of units available at each price. This is then multiplied by 12 to get annual potential rental income for each size of unit. Current annual income (effective gross income) is calculated in the same manner, using the number of units currently occupied instead of the total number of units.

Unit Size	Potential Annual Income	Current Annual Income
1 BR	\$ 157,500	\$ 144,900
2 BR	351,000	312,000
3BR	<u>252,000</u>	<u>168,000</u>
Total	\$ 760,500	\$ 624,900

NOI calculations:

Potential gross income	\$ 760,500
– Vacancy & collection allowance	<u>135,600</u>
Effective gross income	624,900
– Operating expenses	<u>226,250</u>
Net operating Income	\$ 398,650

The cap rate is then

$$r = \frac{NOI}{V} = \frac{398,650}{5,000,000} = 7.97\%$$

- b) What is the gross rent multiplier for this property?

$$GRM = \frac{5,000,000}{760,500/12} = 78.90$$

- c) Create a forecasted pro forma based on current market conditions. What is your cap rate based on this information?

Potential gross income	\$ 760,500
– Vacancy & collection allowance (10%)	<u>76,050</u>
Effective gross income	684,450
– Operating expenses	<u>226,250</u>
Net operating Income	\$ 458,200

The cap rate in this case is

$$r = \frac{548,200}{5,000,000} = 9.16\%$$

- d) Suppose that market cap rates for similar apartment properties are 11%. Is this property a good buy at the current asking price? Explain.

Probably not. Since the cap rate for this property is below the current market rate of 11%, either this property is priced too high, or it is generating too little income for its price.

- e) How much could you pay for the property in order to ensure an 11% cap rate?

$$V = \frac{NOI}{r} = \frac{458,200}{0.11} = \$4,165,455.$$

- f) Why might the cap rate you calculated in part (c) be a misleading of the investment's true potential?

First, cap rates do not account for the riskiness of the individual project. Although comparing to similar properties in the market does provide some control for risk, it is not perfect. If there is some factor that makes this particular apartment less risky than others in the area, it might still be a good investment.

Furthermore, cap rates implicitly assume that the NOI for the property is relatively stable. If the rents are expected to increase in the future (compared to other apartment properties) or operating expenses are expected to decrease, then the cap rate once again may give a misleading picture of the true return on this investment.

- 4) (18 points) You are considering investing in a small, retail strip center in west Wichita. The gross leasable area is 20,000 square feet, and it rents for \$12.50 per square foot (psf). All of its leases are gross leases. Currently, the average vacancy rate for retail space in west Wichita is 15%. The asking price for this property is \$1,062,500.

Annual operating expenses are expected to be as follows:

Utilities	\$30,000
Maintenance	14,375
Management expenses	10% of EGI
Property insurance	10,000
Property taxes	20,000

You can obtain 20-year, 7.50% financing from Friendly Bank for up to 75% of the purchase price. The annual debt service for this loan will be \$77,035.

- a) Construct the pro forma operating statement for this center. What is the net operating income you would anticipate in the first year if you purchase this center?

Potential gross income (\$12.50 × 20,000)	\$ 250,000
– Vacancy & collection allowance (15%)	<u>37,500</u>
Effective gross income	212,500
– Operating expenses	<u>95,625</u>
Net operating Income	\$ 116,875

- b) Based on your calculation in part (a), what is the cap rate for this property?

$$r = \frac{NOI}{V} = \frac{116,875}{1,062,500} = 11\% .$$

- c) What is the operating expense ratio for this property?

$$OER = \frac{OE}{EGI} = \frac{95,625}{212,500} = 45\% .$$

- d) What is the equity dividend rate for this property? Explain briefly any difference between this rate and the cap rate you calculated in part (b). Does this property exhibit positive, negative, or neutral leverage?

$$EDR = \frac{NOI - ADS}{Value - Loan} = \frac{116,875 - 77,035}{1,062,500 - 796,875} = \frac{39,840}{265,625} = 15\% .$$

This investment exhibits positive leverage, as is shown by the fact that the cash-on-cash return is higher than the cap rate. This happens because the cost of debt (the mortgage constant) is lower than the total return on the asset (the cap rate).

- e) What is the debt-coverage ratio for this property?

$$DCR = \frac{NOI}{ADS} = \frac{116,875}{77,035} = 1.52 .$$

- f) What is the breakeven ratio for this property?

$$BER = \frac{OE + ADS}{EGI} = \frac{95,625 + 77,035}{212,500} = \frac{172,660}{212,500} = 81.25% .$$

- g) What is the gross income multiplier for this property?

$$GIM = \frac{V}{EGI} = \frac{1,062,500}{212,500} = 5 .$$

- h) What is the net income multiplier for this property?

$$NIM = \frac{V}{NOI} = \frac{1,062,500}{116,875} = 9.09 .$$

- 5) (15 points) You are considering developing a Class A office building. Your preliminary estimate of value is \$2 million. Your lender is willing to provide a 5-year balloon loan at 9% on a 30-year amortization schedule and monthly payments. The minimum debt coverage ratio (DCR) is 1.2 and the maximum loan-to-value (LTV) ratio is 75%.

Recent sales for Class A office buildings have indicated that cap rates are in the 9.5% range. Your forecast of stabilized NOI is \$190,000, which reflects a 4% vacancy allowance, and \$102,800 in operating expenses.

- a) Based on your preliminary forecast and your lender's underwriting criteria, what is the maximum loan amount you can expect?

LTV-based

$$\text{Maximum Loan} = \text{Value} \times \text{max LTV} = 2,000,000 \times 0.75 = \$1,500,000.$$

DCR-based

The maximum ADS = NOI / DCR = 190,000 / 1.2 = \$158,333. Thus, the maximum monthly debt service is \$158,333 / 12 = \$13,194.44.

Enter PMT = (13,194.44), N = 30 × 12 = 360, P/Y = 12, I/Y = 9, FV = 0, and solve for PV = 1,639,830.

Maximum loan amount

The maximum loan allowed is the minimum of these two figures, or \$1.5 million.

- b) After looking at your application package, your lender informs you that its underwriting guidelines require a minimum 7% vacancy allowance. After adjusting the NOI to reflect the increased vacancy, what is the maximum loan amount you can expect now? [Hint: You will want to recalculate the maximum loan amounts based on both the LTV and DCR ratios.]

To solve this, reconstruct the original pro forma, starting with NOI and working your way up. Then use your PGI figure to recalculate NOI using the new vacancy allowance.

	Original Figures	New Figures
PGI	\$ 305,000	\$ 305,000
– V&C	<u>12,200</u>	<u>21,350</u>
EGI	292,800	283,650
– OE	<u>102,800</u>	<u>102,800</u>
NOI	\$ 190,000	\$ 180,850

Next, recalculate the maximum loan permissible under each constraint.

LTV-based

First, note that the value of the property is different with the new NOI. Now the value is

$$V = \frac{NOI}{r} = \frac{180,850}{0.095} = 1,903,684.$$

Using this, max Loan = Value \times max LTV = 1,903,684 \times 0.75 = \$1,427,763.

DCR-based

The maximum ADS = NOI / DCR = 180,850 / 1.2 = \$150,708. Thus, the maximum monthly debt service is \$150,708 / 12 = \$12,559.03.

Enter PMT = (12,559.03), N = 30 \times 12 = 360, P/Y = 12, I/Y = 9, FV = 0, and solve for PV = 1,560,859.

Maximum loan amount

The maximum loan allowed is the minimum of these two figures, or \$1,427,673.

- c) Based on the loan amount you calculated in part (b), what is the annual debt service on this loan? What is the resulting debt coverage ratio?

Enter PV = 1,427,763, N = 30 \times 12 = 360, P/Y = 12, I/Y = 9, FV = 0, and solve for PMT = (11,488).

Thus, ADS = 11,488 \times 12 = 137,857.

$$DCR = \frac{NOI}{ADS} = \frac{180,850}{137,857} = 1.31.$$

d) What is the balloon payment that will be due on this loan at the end of 5 years?

With the above entries in your financial calculator, enter $N = 5 \times 12 = 60$ and solve for $FV = (1,368,941)$.

6) (12 points) Consider the following two mutually exclusive projects:

Project A		Project B	
n	\$	n	\$
0	(100,000)	0	(50,000)
1	20,000	1	10,000
2	10,000	2	30,000
3	(15,000)	3	(10,000)
4	250,000	4	30,000
		5	100,000

a) Calculate the NPV and IRR for each of these projects. Assume a 12% discount rate. Which project is preferred based on its NPV? Which is preferred based on its IRR?

$$NPV_A = \$74,032$$

$$IRR_A = 30.74\%$$

$$NPV_B = \$51,535$$

$$IRR_B = 35.89\%$$

Based on NPV, Project A is preferred. Based on IRR, Project B is preferred.

b) Use the capital accumulation method to determine which of the projects is preferred. Assume a reinvestment rate of 12% and a safe rate of 4%.

Begin by discounting back negative cash flows at the safe rate until they are completely covered by positive cash flows or brought to date 0.

Project A			
n	\$		
0	(100,000)		
1	20,000		
2	10,000	+ (14,423) = (4,423)	→▲
3	(15,000)		
4	250,000		

+ (4,253) = 15,747

Next, compound forward positive cash flows using the reinvestment rate to the terminal date.

Project A	
n	\$
0	(100,000)
1	15,747
2	0
3	0
4	250,000
5	

$280,000 + 24,778 = 304,778$

Follow the same process for Project B:

Project B	
n	\$
0	(50,000)
1	10,000
2	30,000
3	(10,000)
4	30,000
5	100,000

$+ (9,615) = 20,385$
 $+ 33,600 + 28,639 + 15,735 = 177,974$

Finally, adjust for differences in the initial investment amounts:

Project B	
n	\$
0	(50,000)
1	0
2	0
3	0
4	0
5	177,974

$+ (50,000)$
 $+ 88,117 = 266,091$

Thus, the two projects provide the following capital accumulations. Based on these calculations, Project A is preferred.

Project A		Project B	
n	\$	n	\$
0	(100,000)	0	(100,000)
1	0	1	0
2	0	2	0
3	0	3	0
4	0	4	0
5	304,778	5	266,091