

Practice Problems for Real Estate EMBA Exam

1. Mortgage Mathematics: A syndication has purchased the Town and Country regional shopping center based on a 10% cap rate. The property generates an annual net operating income of \$848,500. The lender is willing to lend this syndication 75% of the appraised value (LTVR) on a 25 year loan at 8% interest amortized monthly.

- a. What is the appraised value of the property ?
- b. Compute what the debt service is per month.
- c. Prepare an amortization schedule for the first 6 months that the loan is outstanding. The amortization schedule should resemble the following format:

Month	Beg Balance	Debt Service	Interest	Principal	End Balance
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- d. If the syndication flips (sells) the property at the end of the 10th year, what is the balloon payment on the mortgage at the end of the 10th year? The balloon payment is defined here as the outstanding loan amount.

2. Mortgage Mathematics: The DUMPIE (Downwardly Mobile) Co. has decided to purchase and develop a tract of land. DUMPIE Co. secures a \$200,000, 20 year, 12 percent mortgage on the property from Loan Shark Mortgage Co. Loan Shark Mortgage Co. charges 1 discount point on this loan as well as 2 percent prepayment penalty on early debt retirement. After 4 years, DUMPIE Co. changes plans and decides to sell the property and develop another site.

- a. How much will the lender actually disburse?
- b. What is the unpaid mortgage balance at the end of year 4?
- c. Compute the prepayment penalty.
- d. Determine the effective yield (borrowing cost) on this loan.

3. Building Envelope: Gotham City has a comprehensive zoning ordinance which is applicable for all portions of the city and applies to all land use classes. (i.e. one size fits all). The zoning ordinance is as follows:

Lot Coverage Ratio: .30
Floor Area Ratio (FAR): 3
Parking Requirements:
340 Square Feet per Stall
One Stall for every 500 Square Feet of Gross Building Area
Height Restriction: 48 feet
Height Per Story: 12 feet

A developer has a 2 acre tract of land and he desires an 80% building efficiency ratio.

- a. What is the number of stories permissible?
- b. What is the total gross building area (for all buildings combined)?
- c. What is the total net rentable area (for all buildings combined)?
- d. Given that the investor wishes to build the maximum floor area allowed per building, how many buildings should he build?
- e. How many parking spaces are required?
- f. What is the total square feet of parking?

4. Tests of Solvency (Backdoor): A developer has recently acquired a 20,000 square foot site. The total cost of the land (including indirect or soft costs) is \$10,000,000. The zoning code allows a basic floor area ratio (FAR) of 18. The anticipated building efficiency is 85% based on the architect's plans for the proposed building. Market research reveals that market rents are currently \$30.00 per square foot of net rentable area and property taxes are \$6 per square foot of total gross building area. Furthermore, the average vacancy rate and operating expenses (excluding property taxes) for the area are 7% and 40% respectively, of potential gross income. Lenders are currently offering loans at 7% interest with an amortization period of 30 years and a term of 10 years. Payments are monthly (12 payments per year). The required debt service coverage ratio (DCR) is 1.3. If your partners in this venture require a before tax cash-on-cash (return on equity) of 10%, what is the justified building budget (hard cost)?

5. Buydowns: A home in a new development is available for sale that could normally be financed with an \$100,000 at a 10% rate for 25 years. If the borrower can only qualify for the house based on an 8% (but his income will rise so that he can cover the 10% rate by the fifth year), how much does the builder have to give to the bank to buy down the payments for the first 5 years?

6. Adjustable Rate Mortgage: Assume that a lender offers Mr. Murdoch a 30-year, \$75,000 adjustable rate mortgage with the following terms.

Initial interest rate = 10.5%
Index = 1-year Treasuries (1 year CMT)
Payments are adjusted each year
Margin = 2%
Interest rate cap = 2% annually; 5% lifetime
Negative amortization = Yes
Discount points = 2%

Based on estimated forward rates computed from the yield curve on U.S. Treasury bills, the index to which the ARM is tied is forecasted to be as follows: end of year (EOY) 1 = 10%, EOY2 = 8%, EOY3 = 12%; EOY4 = 14%. Compute the payments, loan balances, and yield for the restricted ARM for the five-year period.

7. Breakeven Interest Rate: K.C. Sunshine is concerned over a financing problem he is currently facing. He would like to purchase a new warehouse-office property for \$2,000,000. However, he is faced with the decision over whether he should use 70 percent or 80 percent financing. The 70 percent loan can be obtained at 10 percent interest for 25 years. The 80 percent loan can be obtained at 11 percent interest for 25 years. NOI is expected to be \$190,000 per year and increase at 3 percent annually, the same rate at which the property is expected to increase in value. The building and improvements represent 80 percent of value and will be depreciated over 31.5 years (1/31.5 per year). The project is expected to be sold after five years. Sunshine's tax bracket is 28 percent.

- a. What would the BTIRR and ATIRR be at each level of financing (assume annual mortgage amortization)?
- b. What is the break-even interest rate (BEIR) for this project?

Solutions to Problem Set

1. Mortgage Mathematics:

a. What is the appraised value of the property?

$$\text{Net Operating Income} \div \text{Cap Rate} = \text{Estimated Value}$$

$$\$ 848,500 \div .10 = \$ 8,485,000$$

b. Compute what the debt service is per month.

To compute the debt service, we must first calculate the mortgage amount.

Property Value	\$ 8,485,000
* LTVR	* <u> .75</u>
Loan Amount	\$ 6,363,750

$$\text{Mortgage Constant (} i = .08 \div 12, t = 300 \text{ months)} = .00771816$$

$$\text{Loan Amount} * \text{Mortgage Constant} = \text{Monthly Debt Service}$$

$$\$6,363,750 * .00771816 = \$49,116.45$$

c. Prepare an amortization schedule for the first 6 months that the loan is outstanding

Month	Mtg Balance	Debt Service	Interest	Principal
1	6,357,058.55	49,116.45	42,425.00	6,691.45
2	6,350,322.48	49,116.45	42,380.39	6,736.06
3	6,343,541.51	49,116.45	42,335.48	6,780.97
4	6,336,715.33	49,116.45	42,290.28	6,826.18
5	6,329,843.65	49,116.45	42,244.77	6,871.69
6	6,322,926.15	49,116.45	42,198.96	6,917.50

d. If the syndication flips (sells) the property at the end of the 10th year, what is the balloon payment on the mortgage at the end of the 10th year? The balloon payment is defined here as the outstanding loan amount.

Note: The problem essentially involves calculating the Present Value of the Lender's Remaining Cash Flow (Debt Service).

$$\text{Mo. Debt Service} * \text{PVAF (} i = .08 \div 12, t = 180 \text{ months)} = \text{Balloon Payment}$$

$$\$49,116.45 * 104.6405926 = \$5,139,574.43$$

2. Mortgage Mathematics:

- a. How much will the lender actually disburse?

$$\begin{aligned}\text{Contract Loan Amount} * (1 - \text{Number of Points}) &= \text{Amount Disbursed} \\ \$200,000 * (1 - .01) &= \$198,000\end{aligned}$$

- b. What is the unpaid mortgage balance at the end of year 4?

Note: We must first compute the monthly debt service. The monthly debt service is based on the contract loan amount rather than the actual amount disbursed.

$$\begin{aligned}\text{Contract Loan Amount} * \text{MC}(i = .12 \div 12, t = 240 \text{ months}) &= \text{Monthly Debt Service} \\ \$200,000 * .011010861 &= \$2,202.17\end{aligned}$$

$$\begin{aligned}\text{Monthly Debt Service} * \text{PVAF}(i = .12 \div 12, t = 192 \text{ months}) &= \text{Unpaid Mortgage} \\ \text{Balance } \$2,202.17 * 85.19882367 &= \$187,622.29\end{aligned}$$

- c. Compute the prepayment penalty.

$$\begin{aligned}\text{Unpaid Mortgage Balance} * \text{Penalty} &= \text{Prepayment Penalty} \\ \$187,622.29 * .02 &= \$3,752.45\end{aligned}$$

- d. Determine the effective yield (borrowing cost) on this loan

$$\begin{aligned}\text{Unpaid Mtg Bal @EOY4} + \text{Prepayment Penalty} &= \text{Lender's Final CF} \\ \$187,622.29 + 3,752.45 &= \$191,374.74\end{aligned}$$

$$\begin{aligned}\text{Lender's Initial Investment} &= \$198,000 \\ \text{Lender's Cash Flow (Debt Service) Per Month} &= \$2,202.17\end{aligned}$$

Thus, we are trying to find the IRR for the lender as follows:

$$198,000 = [2,202.17 * \text{PVAF}(i\% \div 12, 48 \text{ months})] + [191,374.74 * \text{PVF}(i\% \div 12, 48 \text{ months})]$$

$$\text{IRR} = .127 \text{ or } 12.7\%$$

3. Building Envelope:

a. What are the number of stories permissible?

Height Restriction	48 feet
÷ Height Per Story	<u>÷ 12 feet</u>
Number of Floors	4 Stories

b. What is the total gross building area (for all buildings combined)?

Note: The total gross building area (TGBA) differs depending on whether you include the lot coverage ratio or exclude it. For our purposes, we include the LCR constraint.

Number of Acres	2 Acres
* <u>SQFT Per Acre</u>	* <u>43,560</u> SQFT
Number of SQFT	87,120 SQFT
* <u>Lot Coverage Ratio</u>	* <u>.30</u>
SQFT for First Floor	26,136 SQFT
* <u>Number of Stories</u>	* <u>4</u> Floors
Total GBA with LCR	104,544 SQFT <--- Answer

Number of Square Feet	87,120 SQFT
* <u>Floor Area Ratio (FAR)</u>	* <u>3</u>
Total GBA without LCR	261,360 SQFT

c. What is the total net rentable area (for all buildings combined)?

Number of Acres	2 Acres
* <u>SQFT Per Acre</u>	* <u>43,560</u> SQFT
Number of SQFT	87,120 SQFT
* <u>Lot Coverage Ratio</u>	* <u>.30</u>
SQFT for First Floor	26,136 SQFT
* <u>Number of Stories</u>	* <u>4</u> Floors
Total GBA with LCR	104,544 SQFT
* <u>Building Efficiency</u>	* <u>.80</u>
Net Rentable Area	83,635 SQFT

d. Given that the investor wishes to build the maximum floor area allowed per building, how many buildings should he build?

Answer: It varies depending on the topography, views, etc. As long as you defend Your answer, this is a judgement call. You must however, have some rationale.

3. Building Envelope: (continued)

e. How many parking spaces are required?

Number of Acres	2 Acres
* <u>SQFT Per Acre</u>	* <u>43,560 SQFT</u>
Number of SQFT	87,120 SQFT
* <u>Lot Coverage Ratio</u>	* <u>.30</u>
SQFT for First Floor	26,136 SQFT
* <u>Number of Stories</u>	* <u>4 Floors</u>
Total GBA with LCR	104,544 SQFT
÷ <u>One Stall/500 SQFT TGBA</u>	÷ <u>500 SQFT</u>
Number of Parking Stalls	209 Stalls

f. What is the total square feet of parking?

Number of Parking Stalls	209 Stalls
* <u>340 SQFT per Stall</u>	* <u>340 SQFT/Stall</u>
Total SQFT of Parking	71,060 SQFT

4. Tests of Solvency: Backdoor

Land Area	20,000
Floor Area Ratio (FAR)	18
Total Gross Building Area	360,000
Building Efficiency	0.85
Net Rentable Area	306,000
Potential Gross Rent (PGI) per Sqft	30.00
Vacancy/PGI	0.07
Operating Expenses/PGI	0.40
Property Taxes per Sqft	6.00
Debt Service Coverage Ratio	1.3
Before Tax Cash on Cash (ROE)	0.10
Terms of Loan	
Amortization Period (in years)	30
Payments per Year	12
Period of Loan (in years)	10
Interest Rate	0.07
Mortgage Constant	0.0798363
Land and Indirect Costs	10,000,000

		Potential Gross Income	9,180,000		
		- <u>Vacancy</u>	<u>642,600</u>		
		Effective Gross Income	8,537,400		
		- <u>Operating Expenses</u>	<u>3,672,000</u>		
		- <u>Property Taxes</u>	<u>2,160,000</u>		
		Net Operating Income	2,705,400		
Net Operating Income	2,705,400			Net Operating Income	2,705,400
<u>Divided by: DCR</u>	<u>1.3</u>			- <u>Debt Service</u>	<u>2,081,077</u>
Debt Service	2,081,077			Before Tax Cash Flow	624,323
<u>Divided by: Mtg Constant</u>	<u>0.079836</u>			<u>Divided by: ROE</u>	<u>0.1</u>
Justified Mortgage	26,066,801			Justified Equity	6,243,231
		Justified Investment	32,310,032		
		- <u>Land & Indirect Costs</u>	<u>10,000,000</u>		
		Funds for Construction Budget	22,310,032		
		<u>Divided by: Gross Bldg Area</u>	<u>360,000</u>		
		Justified Hard Cost per Sqft	\$61.97		

5. Buydowns:

Monthly payment based on \$100,000 loan @ 10% for 25 years = \$908.70
 Monthly payment based on \$100,000 loan @ 8% for 25 years = \$771.82
 Difference in payments for first 5 years \$136.88

Buydown = \$136.88(MPVIFA, 10%, 60 mos.) = \$136.88(47.065369) = \$6,442.31

6. Adjustable Rate Mortgage:

Compute the payments, loan balances, and yield for an ARM that has a 2% annual and 5% lifetime interest rate cap and accumulates negative amortization.

Principal = \$75,000 Points = 2.00%
 Term = 30 years
 Initial Rate = 10.5%

Year	(1) BOY Balance	(2) Uncapped Interest Rate	(3) Capped Interest Rate	(4) Monthly Interest Rate (3)/12	(5) Payments (@ Capped Rate)	(6) Monthly Interest (1)x(2)/12	(7) Monthly Amort (5)-(6)	(8) Annual Amort (@ Uncapped Rate)	(9) EOY Balance (1)-(8)
0									
1	\$75,000	10.5%	10.5%	0.88%	\$686.05	\$656.25	\$29.80	\$375.38	\$74,625
2	74,625	12.0%	12.0%	1.00%	770.39	746.25	24.15	306.25	74,318
3	74,318	10.0%	10.0%	0.83%	659.92	619.32	40.60	510.14	73,808
4	73,808	14.0%	12.0%	1.00%	768.68	861.10	(92.42)	(1,183.06)	74,991
5	74,991	16.0%	14.0%	1.17%	899.00	999.88	(100.88)	(1,303.43)	76,295

Yield:
 \$73,500 = \$686.05 (MPVIFA, 7%, 12 months) +
 \$770.39 (MPVIFA, 7%, 12 months)x(MPVIF, 7%, 12 months) +
 \$659.92 (MPVIFA, 7%, 12 months)x(MPVIF, 7%, 24 months) +
 \$768.68 (MPVIFA, 7%, 12 months)x(MPVIF, 7%, 36 months) +
 \$899.00 (MPVIFA, 7%, 12 months)x(MPVIF, 7%, 48 months) +
 \$76,294.72 (MPVIF, 7%, 60 months)

Yield to lender = 12.74%

7. Breakeven Interest Rate:

	<u>80% Loan</u>	<u>No Loan</u>
Before Tax IRR	17.12%	12.50%
After Tax IRR	13.71%	9.25%

Breakeven Interest Rate = 9.25% / (1-.28) = 12.85%

