

M.I.T.
Sloan School of Management

Fall 1998
15.415

Prof. Denis Gromb

MIDTERM 2

Section B

Monday, November 9, 1998

The exam is between **08:10am** and **09:50am**. Books and lecture notes are not allowed. One double-sided sheet of personal notes written reasonably large is allowed. There are 5 independent questions. Do not line up equations without explanation: **No Explanations, No Points** (unless otherwise specified).

- Please, write your name at the top of **each** page **NOW!**
- Answer each question in the corresponding space
- Keep the package stapled together
- **To avoid chaos and ensure equity among the students:**
 - If you finish before 09:35am, you can hand in your exam and leave the room
 - **If you finish after 09:35am, please STAY SEATED UNTIL YOUR EXAM IS COLLECTED AT YOUR DESK**
 - Once your exam is collected, please leave the room in silence

GOOD LUCK!

Question 1 (20 pts)	
Question 2 (20 pts)	
Question 3 (20 pts)	
Question 4 (20 pts)	
Question 5 (20 pts)	
Total (100 pts)	

Question 1 [20 points]

No explanations needed. Circle **one or several** answers per question. You will get credit for a question only if you circle **all** the correct answers.

1. Which of the following statements are correct?
 - (a) The returns of stock A and a put on stock A are always positively correlated
 - (b) The returns of stock A and a put on stock A are always negatively correlated
 - (c) The returns of stock A and a call on stock A are always positively correlated
 - (d) The returns of stock A and a call on stock A are always negatively correlated
 - (e) None of the above

2. Suppose that investors can form portfolios with only two risky assets the return of which are not perfectly positively or negatively correlated. There is no riskless asset. Which of the following statements are correct according to Optimal Portfolio Theory?
 - (a) The relative weights on A and B are the same for all investors
 - (b) The relative weights put by an investor on A and B depend on her risk aversion
 - (c) Any portfolio of A and B is on the Portfolio Frontier
 - (d) Any portfolio of A and B is on the Efficient Portfolio Frontier
 - (e) None of the above

3. Suppose that investors can form portfolios with the riskless asset and only two risky assets the return of which are not perfectly positively or negatively correlated. Which of the following statements are correct according to Optimal Portfolio Theory?
 - (a) The relative weights on A and B are the same for all investors
 - (b) The relative weights put by an investor on A and B depend on her risk aversion
 - (c) Any portfolio of A and B is on the Portfolio Frontier
 - (d) Any portfolio of A and B is on the Efficient Portfolio Frontier
 - (e) None of the above

4. Which of the following statements are correct?
 - (a) Equity is generally junior with respect to debt
 - (b) Equity is generally senior with respect to debt
 - (c) The Put-call parity relation holds for European and American options
 - (d) Put call parity holds only for American options
 - (e) None of the above

Question 2 [20 points]

State	1	2	3
Probability	1/3	1/3	1/3
Asset A's return	10%	8%	6%
Asset B's return	10%	4%	7%

a) What are the expected returns and the variance-covariance matrix of assets A and B?

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[Question 2.a. continued]

b) Would you invest all your wealth in the portfolio of assets A and B with expected return 7.5%? If yes, explain why. If no, explain why. If maybe, explain under which conditions you would.

Question 3 [20 points]

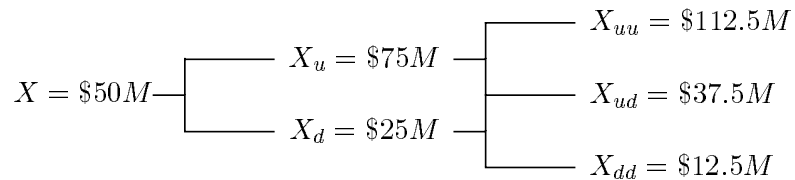
XYZ Inc. has just been founded today (January 1, 1999). Its business will generate a perpetual \$10 annual earnings-per-share at year end. That is, the earnings will first accrue on January 1, 2000, then on January 1, 2001, etc. XYZ's market capitalization rate is and will remain constant at 10%. Moreover, XYZ is committed to paying a constant dividend D in perpetuity at the end of every quarter. That is, the dividend will first be paid on April 1, 1999, then on July 1, 1999, etc.

a) What is the value of D ? What is XYZ's PVGO?

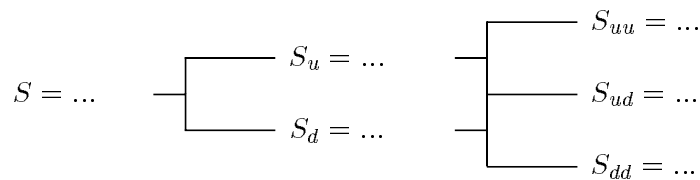
b) Suppose instead that XYZ decided not to pay any dividend for the next 5 years (i.e., until and including January 1, 2004) and then to pay a first dividend of \$7 on April 1, 2004 and let it grow at a rate g every quarter in perpetuity. What would g have to be? Which dividend policy is preferred by XYZ's shareholders?

Question 4 [20 points]

The annual risk-free rate is flat at 10%. XYZ Inc. has 500,000 shares. Its debt has a \$40M face value and a 2-year maturity. The process governing the value of XYZ's assets over the next two years is described by the following binomial tree in which each period represents one year.



a) Fill in the blanks in the following tree describing the process governing the price of one share of XYZ (give the values of S , S_u , S_d , S_{uu} , S_{ud} and S_{dd}).



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[Question 4.a. continued]

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b) What are the premia on a European and an American put option on one share of XYZ with a 2-year maturity and strike price \$50?

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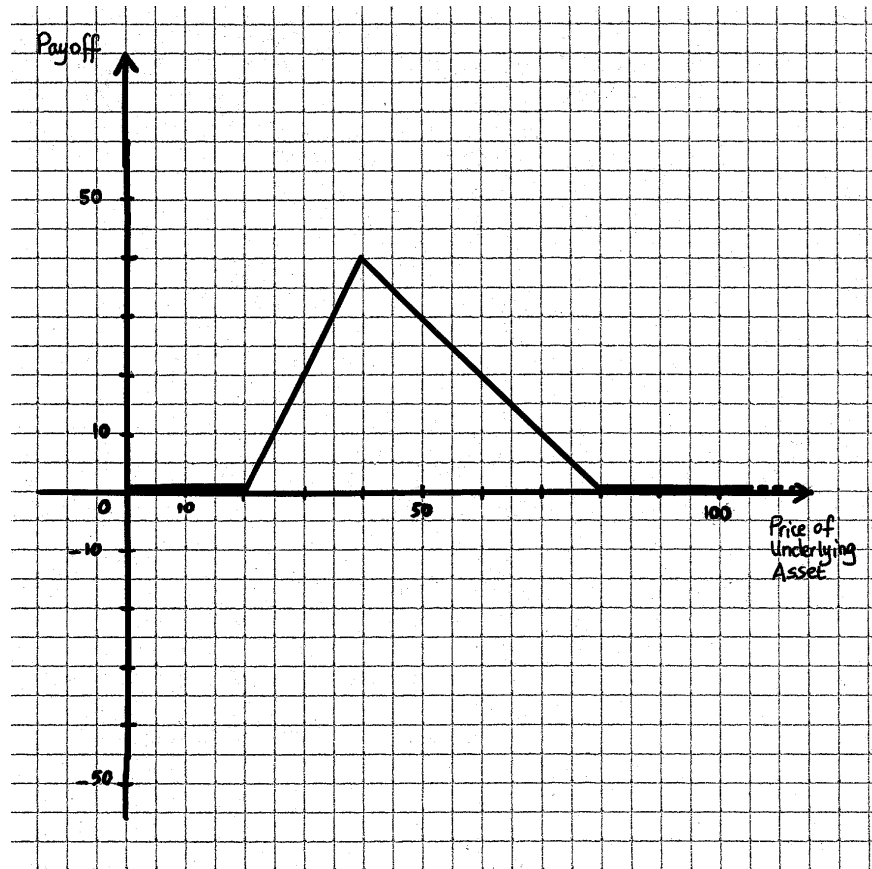
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[Question 4.b. continued]

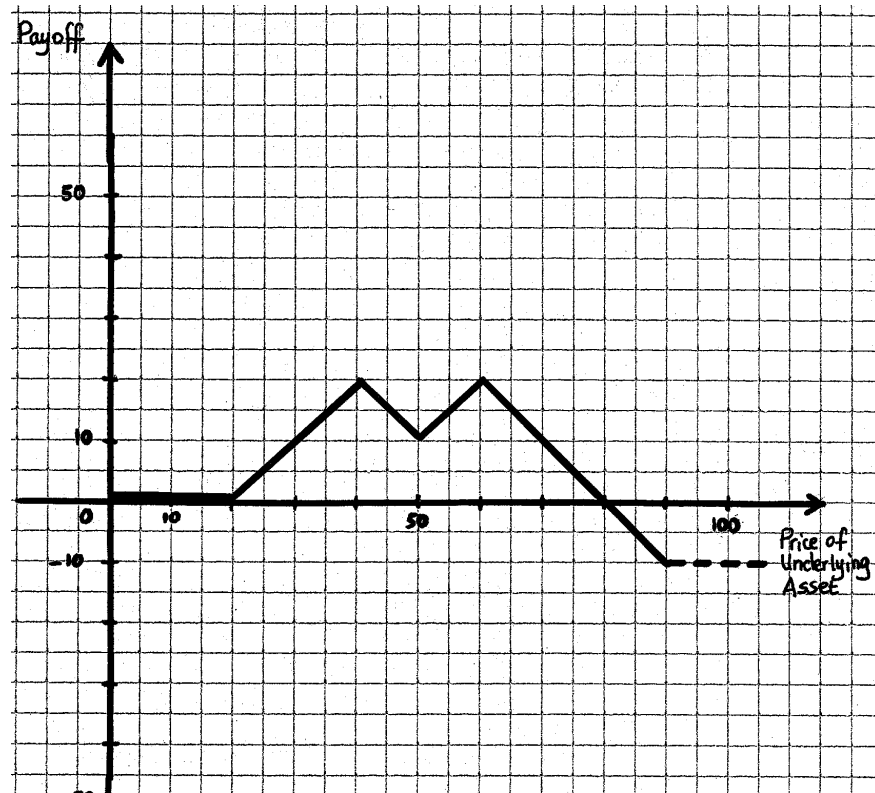
Question 5 [20 points]

No explanations are needed to answer the following questions. No partial credit will be given. In the following questions, the underlying asset is one share of XYZ Inc.'s stock.

a) The following diagram represents a portfolio's payoff 2 months from today depending on XYZ's stock price at that date. Describe as precisely as possible one such portfolio.



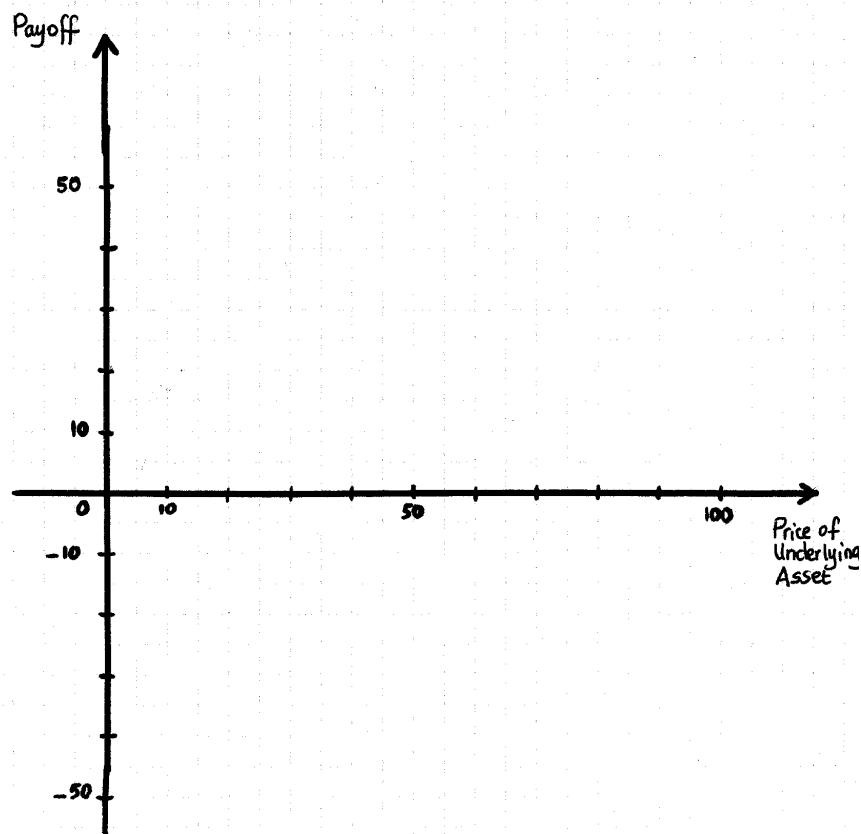
b) The following diagram represents a portfolio's payoff 2 months from today depending on XYZ's stock price at that date. Describe as precisely as possible one such portfolio.



c) Represent on a graph the payoff 3 months from today of the portfolio combining:

- One long European call on one XYZ share with 3-month maturity and strike \$40
- One short European put on one XYZ share with 3-month maturity and strike \$40
- One XYZ share

Indicate the coordinates of each point at which the graph's slope changes.



d) Represent on a graph the payoff 3 months from today of the portfolio combining:

- One riskfree bond with 3-month maturity and face value \$10
- One short European call on one XYZ share with 3-month maturity and strike \$40
- Two short European calls on one XYZ share, with 3-month maturity and strike \$70
- One XYZ share

Indicate the coordinates of each point at which the graph's slope changes.

