The Stanford University Honor Code
The Honor Code is an undertaking of the students, individually and collectively,
that they will not give or receive unpermitted aid in examinations…
that they will do their share and take an active part in seeing to it that others as well as themselves
uphold the spirit and letter of the Honor Code.

I acknowledge and accept the Honor Code.

Name _____________________________  (Signed) _____________________________

Student ID _________________________       Major _____________________________

Undergraduate / Graduate

Please attempt six questions (out of eight) to answer within the allocated time.
Write your answers directly on the question paper in the spaces provided.

July 18, 2001

“As for the years beyond this horizon, there is still, in my judgment, ample evidence that we are experiencing only a
pause in the investment in a broad set of innovations that has elevated the underlying growth in productivity to a rate
significantly above that of the two decades preceding 1995. By all evidence, we are not yet dealing with maturing
technologies that, after having sparkled for a half-decade, are now in the process of fizzling out. To the contrary, once
the forces that are currently containing investment initiatives dissipate, new applications of innovative technologies
should again strengthen demand for capital equipment and restore solid economic growth over time that benefits us all.”

ALAN GREENSPAN
chairman of the Federal Reserve

Drawn from the Testimony of Chairman Alan Greenspan
Federal Reserve Board’s semiannual monetary policy report to the Congress
A five-year currency swap involves two AAA borrowers and has been set at current market interest rates. The swap is for U.S.$100 million against AUD 200 million at the current spot exchange rate of AUD/$ 2.00. The interest rates are 10% in U.S. dollars and 7% in Australian dollars, or annual swaps of U.S.$10 million for AUD 14 million. A year later, the interest rates have dropped to 8% in U.S. dollars and 6% in Australian dollars, and the exchange rate is now AUD/$ 1.9.

(a) What should the market value of the swap be in the secondary market? Assume now that the swap is instead a currency–interest rate swap whereby the dollar interest is set at LIBOR.

(b) What would the market value of the currency–interest rate swap be if these conditions prevailed a year later?
[Answer to Question I, 25 points]

Solution:

(a) The new value of the swap is derived by considering the market value of two streams of cash flows:

- $P_1$: a bond in dollars with 4 years remaining, with annual cash flows of $4 million and a principal repayment of $100 million;
- $P_{AUD}$: a bond in Australian dollars with 4 years remaining, with annual cash flows of AUD 14 million and a principal repayment of AUD 200 million.

The swap to receive AUD and pay U.S. dollars is worth in AUD:

$$\text{Swap} = P_{AUD} (6\%) - \text{spot AUD/\$} \times P_1 (3\%)$$

$$\text{Swap} = \left(\frac{14}{1.06} + \frac{14}{1.06^2} + \frac{14}{1.06^3} + \frac{214}{1.06^4}\right) - 19 \left(\frac{4}{1.03} + \frac{4}{1.03^2} + \frac{4}{1.03^3} + \frac{104}{1.03^4}\right)$$

Swap = 206.93 - 19 (103.72) = AUD 9.86 million

The U.S. dollar value of the swap is 9.86/1.9 = $5.19 million.

Of course, the seller of this swap who receives dollars for Australian dollars will realize a corresponding loss.

(b) Without further information, we can assume that the value of a bond with a floating rate stays constant. Therefore, the swap value will change only because of a change in the AUD interest rate and a change in the exchange rate. This second swap is now worth:

$$\text{Swap} = 206.93 - 19 (100) = \text{AUD 16.93 million}$$

Swap = $8.91 million
Question II (25 points - Offshore banking)

The current exchange rate is $2/£. Cookham Industries is a large British firm that exports computer games to the United States. If the dollar depreciates relative to the pound, Cookham will increase the dollar price it charges its U.S. customers. But it cannot raise its U.S. price enough to fully offset any dollar depreciation because if it does so, it will lose customers to its U.S. competitors. Its rule of thumb is that for every $.10/£ increase in the exchange rate (e.g., from $2.00/£ to $2.10/£) it will increase prices by $5 (e.g., from $200 to $205 per game). The company will not lower down the product price in US Dollar if sterling pound depreciates against US Dollar from, and to below $2/£. Given this rule, it will lose only some of its U.S. sales. Suppose its forecast of annual sales in the United States as a function of the dollar price is:

\[ \text{Quantity sold} = 50,000 - 100 \times \text{price in dollars} \]

Answer the questions below.

a. Plot the British pound value of Cookham’s revenue from its U.S. sales as a function of the exchange rate for exchange rates ranging from $1.50/£ to $3.00/£. What is its exchange rate exposure?

b. Suppose each exchange rate scenario in part (a) is equally likely. What would Cookham’s expected dollar revenue be? What would be its pound revenue in each scenario if it sold forward that number of U.S. dollars at a forward exchange rate of $2/£? Does this seem like an effective hedge?

c. As an alternative, Cookham calculates the hedge ratio (i.e., the number of dollars it will sell forward) as

\[ \frac{\Delta \text{revenue in £}}{\Delta \text{exchange rate in £/$}}, \]

i.e., revenue change induced by exchange rate change

Why do you think this hedge ratio perform so much better in offsetting exchange rate risk than the one you calculated in part (b)?

[Answer to Question II, 25 points]

Let S be the final exchange rate with dimension of ($/£)

a. Revenue (£) = Price x Quantity

\[ = \text{price} \times (50,000 - 100 \times \text{price}) = (1/S)£/$ \times [200 + 5 \cdot (S - 2)/0.1] \cdot [50,000 - 100 \cdot (200 + 5 \cdot (S - 2)/0.1)^2 \text{for S fluctuates within [2.0, 3.0]}; & \]

Revenue (£) = Price x Quantity = price x 50,000 = (1/S)£/$ for S falls within [1.5, 2.0].

b. Integrate on [1.5, 2.0] for integrand \( (1/0.5) \cdot (1/S) \cdot 200 \cdot 50,000 \Rightarrow (20,000,000) \cdot \ln(2.0/1.5) = 20,000,000 \cdot \ln(1.333) = 5,748,640.824 \]

“Plus” Integrate on [2.0, 3.0] for integrand

\[ (1/1) \cdot (1/S) \cdot [200 + 5 \cdot (S - 2)/0.1] \cdot [50,000 - 100 \cdot (200 + 5 \cdot (S - 2)/0.1)] = \text{Integrate on [2.0, 3.0] for integrand (1/S)E(100 + 50 S) \cdot [50,000 - 100 \cdot [100 + 50 S]} \]

\[ = \text{Integrate on [2.0, 3.0] for integrand 50 \cdot 5,000 \cdot (1/S)E(2 + S) \cdot [8 - S] = 250,000 \cdot (1/S)E(16 + 6 S - S^2) = \text{Integrate on [2.0, 3.0] for integrand 250,000 \cdot (1/S)E(16 + 6 S - S^2) = 250,000 \cdot [16 \cdot \ln(3/2) + 6 \cdot (3 - 2) - 0.5 \cdot (9 - 4)] \]

\[ \Rightarrow 250,000 \cdot [16 \cdot (4.05) + 6 \cdot (1) - 0.5 - 5] = 250,000 \cdot (9.98) = 2,495,000 \]

Finally, \( 5,748,640.824 + 2,495,000 = 8,243,640.824 \)

Sell U.S. dollar forward may effectively hedge the sterling pound appreciation risk. It’s easy to implement and it will not disturb the demand with the “forced” U.S. dollar price increase (and the “induced” quantity decrease), as incurred in (b).
**Question III (25 points – FRA and synthetic interest rate futures)**

a. (15 points) A bank sells a “three against nine” $3,000,000 FRA (forward rate agreement) for a six-month period beginning three months from today and ending nine months from today. The purpose of the FRA is to cover the interest rate risk caused by the maturity mismatch from having made a three-month Eurodollar loan and having accepted a nine-month Eurodollar deposit. The agreement rate (per annum) with the buyer is 5.5 percent. There are actually 183 days in the six-month period. Assume that three months from today the settlement rate (per annum) is 4 7/8 percent. Determine how much the FRA is worth and who pays whom -- the buyer pays the seller or the seller pays the buyer.

b. (10 points) Draw a schematic diagram (similar to the one below) and explain step-by-step how to construct a synthetic interest rate future that generates the same hedging effect as the FRA described in (a).

![Figure 11A.1 Synthetic Eurocurrency Interest Rate Pricing](image)

[Answer to Question III, 25 points]
[Answer to Question III, 25 points]

a. Since the settlement rate is less than the agreement rate, the buyer pays the seller (bank) the absolute value of the FRA. The absolute value of the FRA is:

\[
\begin{align*}
&= \$3,000,000 \times [(0.04875 - 0.055) \times 183/360]/[1 + (0.04875 \times 183/360)] \\
&= \$3,000,000 \times [-(0.003177)/(1.024781)] \\
&= \$9,300.52.
\end{align*}
\]

In more detail, we have

\[
N_0 (1 + i_{S_4,T_2}) = N_0 (1 + i_{S_4,T_1}) \times (1 + i_{S_3,T_2})
\]

\[
N_0 (1 + i_{S_4,T_2}) = N_0 \left( \frac{1 + i_{S_4,T_2}}{1 + i_{S_4,T_1}} \right)
\]

\[
N_0 i_{S_4,T_2} = N_0 \left( \frac{1 + i_{S_4,T_2}}{1 + i_{S_4,T_1}} - 1 \right) = N_0 \left( \frac{i_{S_4,T_2} - i_{S_4,T_1}}{1 + i_{S_4,T_1}} \right) = \$3,000,000 \left( \frac{0.055 \times \frac{183}{360} - 0.04875 \times \frac{183}{360}}{1 + (0.04875 \times \frac{183}{360})} \right) = \$9300.7654
\]

b. (modified and corrected on August 10, 2001) Since there is only one currency, the currency dimension is reduced and it becomes a degenerate case. Since the seller (bank) wishes to solve the maturity mismatch problem from the fourth through the ninth months (by a method equivalent to lending the money at an interest rate higher than the deposit rate), the bank chooses to sell the interest rate forward. Equivalently, the seller (bank) may choose to offset the cash inflow (interest income) for the first three months and cash outflow (interest payment) for the next six months by signing a “reverse” contract with a third party. In essence, we may replicate the forward rate arrangement product (from the viewpoint of the bank or seller) in context by

(i) Short (sell) near-term (3-month) interest rate forward, and

(ii) Long (buy) distant-term (9-month) interest rate forward.

(iii) The corresponding diagram collapses to the bottom line in Figure 11A.1.
Question IV (25 points - Dual-currency bonds)
The yield curves in U.S. dollars and Swiss francs are as follows:

<table>
<thead>
<tr>
<th></th>
<th>U.S. Dollar %</th>
<th>Swiss Franc %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 year</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>2 years</td>
<td>12</td>
<td>7</td>
</tr>
</tbody>
</table>

These are yields for zero-coupon bonds of one- and two-year maturity. The spot exchange rate is SF/US$ = 1.5.

a. (5 points) What are the implied one-year and two-year forward exchange rates?

b. (10 points) You contemplate issuing a dual-currency bond. You could issue zero-coupon bonds in both currencies at the interest rate above. Instead, you wish to issue bonds of SF 150 with a coupon C in Swiss francs, paid each year for two years, and reimbursed for $100 at the end of two years. What is the interest rate c% (c = C/150) on the bond that would be consistent with the yield curve above?

c. (10 points) You contemplate issuing a two-year currency option bond. The bond is issued for $100 and gives the option to receive the coupons and principal payment in either dollars or Swiss francs at a fixed exchange rate of SF/US$ = 1.5. A bank gives you quotes on the premiums for SF calls with a strike price of 1/1.5 = 0.66666 US$. The premium for a one-year call is 4 U.S. cents (per Swiss franc) and for a two-year call is 7 U.S. cents. What coupon rate should you set on your currency option bond?

[Answer to Question IV, 25 points]
**[Answer to Question IV, 25 points]**

a. Implicit 1-year and 2-year forward rates are the following:

\[ F_1 = \frac{1.5 \times 1.06}{1.10} = 1.4454 \text{ SF/\$} \]

\[ F_2 = \frac{1.5 \times 1.07^2}{1.12^2} = 1.3691 \text{ SF/\$}. \]

b. Let's denote \( c \) the interest rate at which the bonds should be issued. Cash flows are \( C \) Swiss francs on year 1 and year 2, and \$100 on year 2.

We have:

\[ 150 = \frac{C}{1.06} + \frac{C}{1.07^2} + \frac{1.5 \times 100}{1.12^2} \]

\[ C = 16.74 \]
\[ c = C/150 \]
\[ c = 11.16\%. \]

c. Let's call \( x \) the coupon on the \$100 bond. The currency-option bond cash flows are the following:

<table>
<thead>
<tr>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>- $100</td>
<td>$x</td>
<td>$(100+x)</td>
</tr>
<tr>
<td>or SF 1.5x</td>
<td>or SF 1.5(100+x)</td>
<td></td>
</tr>
</tbody>
</table>

To replicate the cash flows, we first buy two zero-coupon bonds in U.S. $:
- the first bond is a 1-year bond paying \( x \),
- the second bond is a 2-year bond paying \$(100+x)\).

We then buy 2 currency options:
- the first option is a 1-year call SF; the amount is 1.5\( x \),
- the second option is a 2-year call SF; the amount is 1.5\( (100+x) \).

This investment strategy exactly replicates the currency-option bond cash flows. Consequently, its total value at time \( t=0 \) should be equal to $100. We write below the dollar value of this replication portfolio.

<table>
<thead>
<tr>
<th>Market value</th>
<th>Quantity</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-year Bond</td>
<td>1/1.10</td>
<td>( x / 1.10 )</td>
</tr>
<tr>
<td>2-year Bond</td>
<td>1/1.12^2</td>
<td>100+x</td>
</tr>
<tr>
<td>1-year Option</td>
<td>0.04</td>
<td>1.5( x )</td>
</tr>
<tr>
<td>2-year Option</td>
<td>0.07</td>
<td>1.5(100+x)</td>
</tr>
</tbody>
</table>

We have:

\[ 100 = 0.9091x + 79.7194 + 0.7972x + 0.06x + 10.5 + 0.105x \]
\[ 1.8713x = 9.7806 \]
\[ x = 5.23 \]

The interest rate at issuance is 5.23 percent.
**Question V (25 points)**

a. (15 points)

A swap with a maturity of five years was contracted by Papaf Inc. three years ago. Papaf swapped $100 million for DM 250 million. The swap payments were annual, based on market interest rates of 8% in dollars and 4% in DM. In other words, Papaf Inc. contracted to pay dollars and receive DM. The current spot exchange rate is 2 DM/$, and the current interest rates are 6% in DM and 10% in $ (the term structures are flat, i.e., interest rates does not vary with maturity).

i. (10 points) What is the swap payment at the end of year 3? Does Papaf pay or receive?

ii. (5 points) What is the final swap payment at the end of year 5?

b. (10 points)

A French corporation plans to invest in Thailand to develop a local subsidiary to promote its French products. The creation of this subsidiary should help boost its exports from France. The Thai baht is pegged to a basket of currencies denominated by the U.S. dollar, so borrowing in U.S. dollars would reduce the currency risk on this investment. The corporation needs to borrow $20 million for five years. A bank has proposed a five-year dollar loan at 7.75%. The French government wishes to support this type of foreign investments helping French exports. A French government agency can subsidize a 1.50% improvement in French franc interest costs. In other words, the corporation can get a five-year, FF 100 million loan at 7.5% instead of the current market conditions of 9%. The current spot exchange rate is 5.00 FF/$. A bank offers to write a currency swap for a principal of $20 million, whereby the corporation would pay dollars at 7.75% and receive francs at 9%.

What could the corporation do to get an obligation in dollars, its desired currency position, while capturing the French interest rate subsidy?

[Answer to Question V, 25 points]
[Answer to Question V, 25 points]

a.  i.  At the end of year 3, Papaf receives the balance of:
   - receipt of DM 10 million
   - payment of $8 million

   The net cash flow is:
   \[10 - 8 \times 2 = -\text{DM 6 million}\]

   Papaf has to pay DM 6 million (or $3 million).

ii. At the end of year 5, Papaf receives the balance of:
    - receipt of 250 + 10 = DM 260 million
    - payment of 100 + 8 = $108 million

   The net cash flow is:
   \[260 - 108 \times 1.5 = \text{DM 98 million}\]

   Papaf receives DM 98 million (or $65.33 million).

b. The French corporation should:
   - Borrow FF 100 million at the subsidized rate of 7.5 percent.
   - Swap FF for $. The corporation would swap FF 100 million (equal to $20 million),
     agreeing to pay $ at 7.75 percent and receive FF at 9 percent.

   This will create an annual cost saving of FF 1.50 million, compared to a direct borrowing in $.
Question VI (25 points - Hedge Fund Company Long-Term Capital Management)

a. What is the exact definition of a hedge fund? Do hedge funds usually perform adequate hedge on their portfolio?

b. Hedge Fund Long Term Capital Management specialized in trades involving similar securities that differ slightly in yields due to their liquidity or risk characteristics. Why could they make money by “shorting” newly issued 30-year Treasury bond and “longing” previously issued 30-year Treasury bond? (Hint:

The Arbitrage Trade

<table>
<thead>
<tr>
<th>TODAY</th>
<th>ONE MONTH's TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="#" alt="Yield Graph" /></td>
<td><img src="#" alt="Yield Graph" /></td>
</tr>
<tr>
<td>2/28</td>
<td>2/28</td>
</tr>
<tr>
<td>5/28</td>
<td>5/28</td>
</tr>
<tr>
<td>8/28</td>
<td>8/28</td>
</tr>
<tr>
<td>13bp</td>
<td>13bp</td>
</tr>
</tbody>
</table>

Sell the 8/28 (today's "on-the-run" bond)
Buy the 5/28 (today's "old bond")

Net Profit: 13bp (because the on-the-run is 13bp more costly than the old bond).

Buy back the 8/28 (today's "old" bond)
Sell the 5/28 (today's "old old bond")

Net cost: zero (now the two bonds cost the same amount; liquidity premium is now on the new "on-the-run" bond)

c. What had caused the near-bankruptcy of LTCM? What preventive measures should have been adopted by LTCM to prevent the crisis from realizing? Would such preventive effort ever work?

d. How do you compare LTCM’s failure with Leeson’s failure if you deem such comparison meaningful?
[Answer to Question VI, 25 points]
Question VII (25 points – Leeson’s Lessons)
a. Nick Leeson sold short straddles and combined them with long futures contracts. Please draw the payoff diagram (at maturity) of one short straddle plus one long futures. What hybrid would he have created if he combined long call options on the Nikkei Index and with short forward contracts? Please also draw the payoff diagram (at maturity) of one long call option on the Nikkei Index plus one short forward. Why did he sell options instead of buying them? Why didn’t he sell butterfly spread instead?
b. What risk management tools that we have studied in this summer might have saved Barings from the consequences of Leeson’s bold risk-taking (with insufficient hedging)?

[Answer to Question VII, 25 points]
Question VIII (25 points – Arbitrage in infrastructure)

Read the following Economist article about stock exchanges in Europe. Then answer the questions that follow.

Stock Exchanges in Europe

The Hunt For Liquidity
Jul 28th 2001
From The Economist print edition

Competition among Europe’s stock exchanges is keener, thanks to bear markets, new technology and the euro. Liquidity and trading costs will decide who wins.

As businesses go, stock exchanges are rather curious. They are under pressure to consolidate, yet trading platforms proliferate. Considerable economies of scale exist in their activities, yet tiny upstarts and small national exchanges can do well. Exchanges ought to be run like multinational companies, yet they are too often still the financial markets' equivalent of the national football team.

America has only three national and five regional exchanges, but Western Europe still has more than 30 stock exchanges. Most will probably not survive the next ten years. Some will be taken over, others may simply shut down. And one or two are likely to emerge as dominant forces in the cross-border trading of blue-chip shares, the highest-profile and most lucrative bit of the industry.

This race for the top spot is different from competition in other businesses. For a start, many exchanges in Europe are only now beginning to be run as proper companies, rather than as member-dominated public utilities. The three biggest, the London Stock Exchange (LSE), Deutsche Börse and Euronext (the merger of the Paris, Amsterdam and Brussels bourses), have just shed their mutual structure. The LSE became a fully listed company on July 20th, Euronext went public at the beginning of the month, and Deutsche Börse made its stockmarket debut in February.

More than ever, exchanges will now have to find out what exactly their customers want. This ought to be self-evident: a cheap and effective trading system. But it is not that simple. Certainly, those who trade on stock exchanges want low direct costs—that is, brokers' commissions and fees for confirming a trade, for clearing it (registering a share's new ownership) and for settling it, when money changes hands. Yet they also want low indirect costs, in the form of narrow dealing spreads—that is, the difference between buy and sell prices. The more liquid a market is, the narrower the spreads and the less prices are moved by quantities of orders. Liquidity, as one trader puts it, is “what gets business away”. It is the best measure of a stockmarket's cost-effectiveness.

Liquidity will thus be key in determining the winners and losers in this battle of the bourses. And liquidity comes with size, one of the reasons why stock exchanges are often described as natural monopolies. On this measure, the LSE is still some way in front of its rivals. It attracted more new listings last year than either Deutsche Börse or Euronext, with higher turnover (see chart). Still, London will have to pedal hard to keep ahead, for continental rivals as well as young upstarts are catching up. On its first day of business, Virt-X, an electronic exchange launched in July, pinched 23% of all trading in Britain of the shares of GlaxoSmithKline, a drugs company.

A fight for the pie

Turnover on European stockmarkets, % of total year to June 2003

Deutsche Börse 14.6

Euronext 19.1

Other 17.2

Total: £6.49bn

Source: Federation of European Stock Exchanges

Given the steep increase in trading activity over the past few years, there ought to be liquidity aplenty. Cross-border equity portfolio flows in the world's developed markets are reckoned to have quintupled in the past five years, to $1.1 trillion. European flows have grown by even more. The launch of the single currency has set in train a huge reshuffling of portfolios. Institutional investors in Europe now tend to judge sectors almost entirely from a pan-European not a national perspective.

Yet liquidity is by no means abundant. Cross-border equity flows appear vulnerable to sudden drying up. This has been especially true since Russia's default on its bonds in August 1998, followed by the collapse of Long-Term Capital Management, a hedge fund. Subsequently, international investment banks and asset managers have only slowly recommitted risk capital to trading equities.
Other, more structural, factors also point to a dearth of liquidity. The rise in the number of international investors has led to a demand for tradable securities that is not matched by supply, notes Avinash Persaud at State Street, an American bank. Liquidity is squeezed by these investors’ tendencies to act alike: models for managing short-term risk promote similar investment patterns.

Still, while liquidity remains tight, trading costs have come down—mainly because computers are replacing people as trading is automated. However, though costs in Europe vary greatly, they are generally still high. Benn Steil, at the Council on Foreign Relations in New York, puts this down to the heavy European use of intermediaries (that is, old-fashioned stockbrokers) when executing trades, and to Europe’s painfully high costs for clearing and settlement—which can be as much as ten times more than those in America.

Low costs are the chief selling-point of the upstart exchanges in Europe. Thanks largely to their having found more efficient solutions for clearing and settlement, Virt-X and Jiway, an electronic exchange for retail investors, are much cheaper than the established bunch. Virt-X, for instance, offers a “multi-settlement” system that encourages a certain amount of competition on price between Euroclear, Crest and SIS, the three big settlement agencies. From a survey of market participants, Virt-X claims that the average cost of cross-border equity trades in Europe is between euro10 ($8.50) and euro80, while the average cost at Virt-X is only euro2. Jiway offers retail brokers a one-stop-shop for pan-European share-dealing and settlement for 6,000 different shares.

Although it might make sense for stock exchanges to join forces, many bourses in Europe fiercely defend their turf, preferring to carry on independently. Merging exchanges allows liquidity to be pooled; it also offers the means for more efficient clearing and settlement. Here, the Germans and the British do not see eye to eye. Deutsche Börse is all for alliances, such as its union with the Vienna Stock Exchange, but it does not want to give up its vertical “silo”, which includes its own clearing and settlement through Clearstream. The LSE does not rule out mergers either—perhaps with Virt-X, or even with Liffe, London’s derivatives exchange. But it wants to see settlement systems consolidated, favouring a merger between Clearstream and Euroclear. Deutsche Börse wants these to remain separate; one mainly settles equity trades, the other chiefly bond transactions.

Whether exchanges forge alliances or go it alone, the challenges of attracting and retaining liquidity will prove formidable. Cheaper technology allows trading systems to multiply. Traders can look instantly for the best prices. Orders can swiftly be re-routed. That means that exchanges with an apparently impregnable franchise can lose it almost overnight—something that no longer makes for sound sleeping for those who run them.

a. (5 points) Define liquidity in the context of the article.

b. (10 points) Discuss what makes one exchange more appealing than another from the companies’ (customers’) viewpoint. That is, if you are considering listing your company in one of the exchanges, what factors will attract you to a particular exchange instead of another one? Does the “critical mass” (i.e., the number of companies already listed on a particular exchange) matter in your decision?

c. (10 points) Comment and elaborate on the following underlined segment in the title of the article: “Competition among Europe’s stock exchanges is keener, thanks to bear markets, new technology and the euro. Liquidity and trading costs will decide who wins.”

[Answer to Question VIII, 25 points]
[Answer to Question VIII, 25 points]

a. “The more liquid a market is, the narrower the spreads and the less prices are moved by quantities of orders. Liquidity, as one trader puts it, is “what gets business away”. It is the best measure of a stock market's cost-effectiveness.” It makes sense that if a stock can quickly change hands among investors (i.e., owners can quickly sell their stocks and buyers can easily obtain their purchases), the liquidity is high and the spread is low. And according to the “low risk, low return” principle, the spread is naturally low.

b. “More than ever, exchanges will now have to find out what exactly their customers want. This ought to be self-evident: a cheap and effective trading system. But it is not that simple. Certainly, those who trade on stock exchanges want low direct costs -- that is, brokers' commissions and fees for confirming a trade, for clearing it (registering a share's new ownership) and for settling it, when money changes hands. Yet they also want low indirect costs, in the form of narrow dealing spreads -- that is, the difference between buy and sell prices.”

c. Open answer question. Mainly, bear markets, new technology and the euro altogether have boosted competition among Europe's stock exchanges and have strengthened the remaining customers' bargaining power. A sound answer should elaborate along each direction and hopefully mention the reinforcing effects among all the relevant factors.