ISMA CENTRE - THE BUSINESS SCHOOL
OF THE FINANCIAL MARKETS

UNIVERSITY OF READING
ENGLAND

IFID Certificate Programme

Structured Securities

Answers to Exercises

Answers to Exercises

1. Callable Bonds

Question 1

In the case of putable bonds the shoe is on the other foot: the option to retire the bond rests with the investor.

a) Which one or more of the following do you think apply?

- [x] The issuer suffers pre-payment risk
- [ ] The investors earns a higher coupon than on a comparable straight
- [ ] The investors suffers pre-payment risk
- [x] The investor earns a lower coupon than on a comparable straight

Explanation

- The issuer suffers pre-payment risk
- The investor earns a lower coupon than on a comparable straight

Question 2

This exercise is designed to cdonsolidate your understanding of the price behaviour of callable and putable bonds using a simple Excel-based OAS bond pricing model similar to the one described in the previous section.

You can safely skip this exercise if you are already confortable with this topic and with the broad structure of the OAS pricing model.

We shall work with a 4 year bond that is callable at par in years 2 and 3. Please ensure the following data is correctly set in the model:

Cash flows and Yields	**1**	**2**	**3**	**4**
Call price(s)	(blank)	100.00	100.00	100.00
Base yield curve	8.25%	9.00%	9.50%	9.80%
Volatility of short rate	17.00%			

The bond

Type	Callable
Coupon rate	12.00%
Reversion speed	1.40%
Option-adjusted spread	0.00%

a) Complete the table below. Type your answer in each box and validate.

Calculated clean price:

Straight bond	107.2
Callable bond	104.4
Call option	2.83

Please check the calculator settings, above, if your answers don't match.

Explanation

Straight bond **107.27**
Callable bond **104.44**
Call option **2.83**

b) If the bond trades at 104, what is its OAS (%)?

Instructions

You may try different OAS levels by trial-and-error until you arrive at a calculated price of 104.00 for the callable bond. Alternatively, let Excel® find it for you.

Select **Tools | Goal Seek** in the Excel menu. In the dialog box enter the following (shown in **bold**):

Set cell: **Bond_price**
To value: **104.00**
By changing cell: **OAS**

0.20

c) A positive OAS means:

- (•) The bond trades cheap to fair value
- ( ) The bond is likely to be called
- ( ) The bond trades rich to fair value
- ( ) The bond trades at fair value

Explanation
A positive OAS means the bond trades cheap to fair value.

This OAS is added to each and every projected future short rate of interest in the binomial tree so as to reduce the calculated present value of the callable bond to its market price.

d) Keeping the OAS at the level calculated in (b), what would you expect the bond price to be for the following levels of volatility?

Volatility of 1x2 year forward rate	Bond price
14.00%	104.2
17.00%	104.0
20.00%	103.7

Explanation

Volatility of 1x2 year forward rate	Bond price
14.00%	**104.22**
17.00%	**104.00**
20.00%	**103.78**

e) Restore the volatility of the 1x2 year rate back to 17.00% and now change the call price in year 2 to 102.50. Which (one or more) of the following statements are true?

- ☐ The bond is more likely to be called early
- ☑ The embedded option is less valuable
- ☐ The embedded option is more valuable
- ☑ The bond is less likely to be called early

Explanation

- **The embedded option is less valuable**
  The difference between the calculated price of the callable bond and the price of an equivalent straight is smaller.

- **The bond is less likely to be called early**
  The bond has to trade at over 102.00 for the issuer to call it, which is less likely to happen, so the call feature is now less valuable to the issuer.

f) Restore the call price in year 2 back to 100.00. We shall now explore how shifts in the yield curve affect the price of this callable bond, compared with the price of an otherwise identical straight bond. Entering the indicated values in the OAS cell, complete the table below and validate.

OAS	Straight bond	Callable bond	Difference
-1.00%	110.6	106.5	4.12
0.00%	107.2	104.4	2.83
+1.00%	104.0	102.3	1.67
+3.00%	97.86	97.32	0.54

Explanation

OAS	Straight bond	Callable bond	Difference
-1.00%	**110.68**	**106.56**	**4.12**
0.00%	**107.27**	**104.44**	**2.83**
+1.00%	**104.00**	**102.33**	**1.67**
+3.00%	**97.86**	**97.32**	**0.54**

g) Which (one or more) of the following statements are true?

- ☑ The callable bond has lower convexity than the straight bond
- ☑ As yields fall the bond is more likely to be called, and vice versa
- ☑ As yields fall the callable bond behaves more like a 2 year straight bond
- ☑ As yields rise the callable bond behaves more like a 4 year straight bond

Explanation

- **The callable bond has lower convexity than the straight bond**
  This follows from the previous statements: as yields rise the price risk on the callable bond will approximate the risk of a 4 year straight bond. Conversely, as yields fall its price risk will decrease to that of a 2 year bond. As explained in the next section, in fact callable bonds may have negative convexity.

- **As yields fall the bond is more likely to be called, and vice versa**
  The issuer is more likely to want to take advantage of lower market rates by retiring the bond early.

- **As yields fall the callable bond behaves more like a 2 year straight bond**
  Since the bond is more likely to be called at the first opportunity, investors will perceive it effectively as a 2 year bond and it will trade as such.

- **As yields rise the callable bond behaves more like a 4 year straight bond**
  Since the bond is less likely to be called, it will be perceived as (and therefore will trade like) a 4 year bond.

h) Restore the OAS back to 0.00% and now make the bond *putable*, instead of callable. Which (one or more) of the following statements are true?

- [x] As yields rise the putable bond is more likely to be put
- [ ] An increase in volatility reduces the price of the putable bond
- [ ] As yields fall the putable bond behaves more like a 2 year straight bond
- [x] The putable bond has higher convexity than an otherwise equivalent straight

Explanation

- **As yields rise the putable bond is more likely to be put**
  As yields rise the investor has a greater incentive to obtain early repayment and reinvest the proceeds on other bonds paying higher coupons. Conversely, as yields fall the investor has little incentive to reinvest.

- **The putable bond has higher convexity than an otherwise equivalent straight**
  This follows from the previous statement: as yields rise the putable bond behaves more like a 2 year straight bond, and as they fall it behaves more like a 4 year straight bond.

2. Convertible Bonds

Question 1

Consider the following sterling convertible bond:

Issuer:	GG Finance Plc.
Issue amount:	GBP 200 million
Coupon:	5.25% (semi-annual, actual/365 basis)
Maturity:	10 June 2010
Denomination:	GBP 1,000
Convertible until:	10 May 2010
Conversion ratio:	176.9912
Call Features:	Callable at par from 10 June 2005

Settlement date:	10 December 2002
Bond price:	99½
Ordinary share price:	£5.46

a) Calculate the items below to 2 decimal places. Type your answer in each box and validate.

Conversion price (£)	5.65
Parity (%)	96.64
Premium (%)	2.96

(clean price basis)

Explanation

Conversion price	= 1,000 / 176.9912	= £**5.65**
Parity	= 5.46 / 5.65 x 100	= **96.64%**
Premium	= (99.50 - 96.64) / 96.64 x 100	= **2.96%**

b) Which of the following would you expect to happen if, *other things being equal*, GG's share price were to trade down:

- ☐ The bond's price would rise
- ☑ The bond's parity would fall
- ☑ The bond's price would fall
- ☑ The bond's premium would rise

Explanation

- **The bond's parity would fall**
  Parity is the value of the equity in the bond expressed as a percentage of the bond's face value, which is a constant.

- **The bond's price would fall**
  If the shares trade down the equity option becomes less valuable, so the bond should become cheaper.

- **The bond's premium would rise**
  However, whereas the equity value (hence the parity) could fall all the way down to zero, the bond's price will be supported by its bond value: the fact that, if nothing else, it will continue to pay a fixed coupon until maturity, when it will be redeemed at par.

  Therefore, as the shares trade down we should find the premium on the convertible expanding. Conversely, when the shares trade up the premium should contract.

  Of course, other things may not be equal: if the share price were to fall sharply the bond's credit rating may be called into question, so its bond value may also fall.

Question 2

An issuer might favour bonds-cum-warrants as opposed to convertibles because:

a) Bonds cum warrants offer greater structural flexibility to the issuer.

- ◉ True
- ○ False

Explanation
True. The warrants can have different expiry dates than the bonds.

b) In a bond with warrants, the cost of the debt portion is known with certainty and the fixed coupons may be swapped by the issuer into floating coupons.

- ◉ True
- ○ False

Explanation
True. In contrast, a convertible is only outstanding as long as it is not converted, so the cost of the debt is not known with certainty.

c) A bond with warrants can potentially raise more funds for the issuer than a convertible.

- [x] True
- [ ] False

Explanation
True. Exercising the warrants involves paying the issuer additional cash without affecting the status of the associated bond. For convertibles, the conversion option is embedded within the instrument and the debt itself is extinguished when conversion is exercised.

Question 3

Payback period: the number of years it will take to recover the premium paid, given the bond's income advantage.

$$\textbf{Payback Period} = \frac{\textbf{Conversion premium}}{\textbf{(Current yield - Dividend yield)}}$$

$$= \frac{\text{Conversion premium}}{\text{(Coupon/Clean price - Dividend/Share price)}}$$

a) Calculate the figures below, rounded to the nearest 2 decimal places. Type your answer in each box and validate.

Conversion premium (%, dirty price basis)	17.16
Current yield (%)	3.56
Payback period (years)	11

Explanation

Conversion premium (%, dirty price basis)	**17.16**
Current yield (%)	**3.56**
Payback period (years)	**11**

b) The payback can be used to assess the premiums on comparable issues: other things being equal the bond with the shortest payback is preferable. However, as a measure of value it does have some serious conceptual problems.

Which do you think are the most critical problems with the payback method?

- [ ] The bond may not be held for that long
- [x] It does not account for the timing of the income advantage
- [x] It does not factor future dividend growth on the equity
- [ ] It does not factor the accrued interest on the bond, which is a cost

Explanation

- It does not account for the timing of the income advantage
- It does not factor future dividend growth on the equity

Question 4

In this exercise we explore the price behaviour of convertible bonds using an Excel-based model. When you have launched the model on the left, please select the **Structure** worksheet and ensure the bond's characteristics have been set to the ones below.

Settlement date	25-Mar-03
Issue date	25-Sep-02
Maturity	25-Sep-17
Coupon (%)	3.75
Coupon period	Annual
Day count	E30/360
Denomination	5,000.00
Conversion Price	$65.00

Call features[1]

Call Protection until	25-Sep-07
Soft Call Period until	25-Sep-12
Threshold Level (%)	130

Now select the **Market Data** worksheet and ensure the following data is set correctly.

The underlying equity

Share price	$60.00
Price volatility (%)	30.0
Dividend growth (%)	15.00
Dividend yld (% pa)	1.50

The underlying bond

Benchmark yield (%)	6.00
Price volatility (%)	10.0

Correlation	0.45

a) Complete the table below. Type your answer in each box and validate.

Calculated values

Convertible bond	105.2
Parity	92.31
Premium	14.06

Please check the calculator settings, above, if your answers don't match!

Explanation
Calculated values

Convertible bond	**105.29**
Parity	**92.31**
Premium	**14.06**

[1] The bond is callable at par from 25 Sep 2012, or from 25 Sep 2007 subject to the equity having reached a premium threshold of 30% over the conversion price.

b) Is there an income advantage in holding the convertible, rather than the equity?

- [x] Yes
- [ ] No

Explanation
Yes: the bond's current yield is 3.56%, compared with a 1.50% dividend yield for the equity.

c) Would you buy this bond purely on the basis of its income advantage?

- [ ] Yes
- [x] No

Explanation
No: purely on an income advantage basis the bond should trade with a premium of only 8.62% (assuming 15% annual dividend growth), which is well below the actual premium of 14.06%.

d) What is the convertible's price for the following levels of volatility?

Equity Volatility	Convertible Price
20.0%	102.0
30.0%	105.2
40.0%	109.5

Explanation

Equity Volatility	Convertible Price
20.0%	**102.08**
30.0%	**105.29**
40.0%	**109.59**

e) Restore the volatility of the equity to 30.0% and recalculate the convertible's price. Other things being equal, which of the following is true?

- ○ Higher bond price volatility always increases the convertible's price
- ◉ Higher bonds/equities price correlation reduces the convertible's price
- ○ Higher bond price volatility always reduces the convertible's price
- ○ Higher bonds/equities price correlation increases the convertible's price

Explanation
Higher correlation between bonds and equities reduces the convertible's price.

As explained in section *Pricing*, the conversion option embedded in this structure is an **exchange option** (or **spread option**) - i.e. the right to be long the equity and short the fixed coupon bond. In Multi-asset Options - Pricing, we show that:

Volatility of exchange option (σ):

$$\sigma = \sqrt{[\ \sigma_{a1}^2 + \sigma_{a2}^2 - 2 \times \rho_{a1,a2} \times \sigma_{a1} \times \sigma_{a2}\ ]}$$

Where:

σ_{a1} = Volatility of the price of asset A1 (in this case the equity)
σ_{a2} = Volatility of the price of asset A2 (in this case the straight bond)
$\rho_{a1,a2}$ = Coefficient of correlation between the prices of A1 and A2

Higher correlation makes the last term in this equation larger, so it reduces the volatility of the exchange option, hence the convertible's price. It is interesting to note that, depending on the values of these variables, an increase in the volatility of the underlying bond (or indeed of the equity) may increase or reduce the volatility of the exchange option.

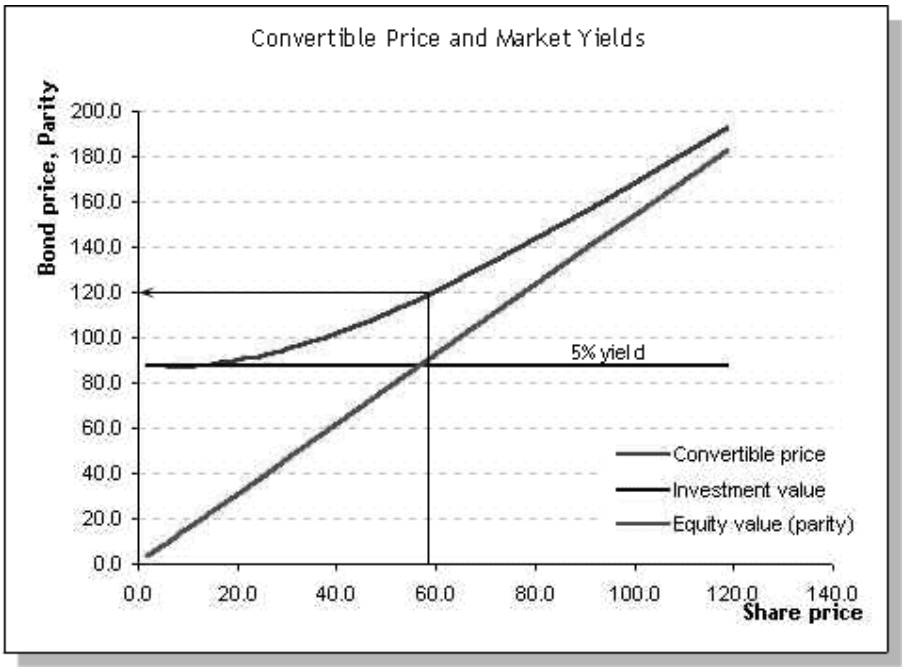
f) Restore the volatility of the benchmark bond price to 10.0% and the correlation coefficient to 0.45. We shall now explore how changes in the price of the underlying equity affect the convertible's price and its premium. Entering the indicated values for the equity price, complete the table below.

Share Price	Convertible Bond Price	Parity	Premium
40.00	90.06	61.54	46.35
50.00	96.87	76.92	25.94
60.00	105.2	92.31	14.06
70.00	115.0	107.6	6.86

Explanation

Share Price	Convertible Bond Price	Parity	Premium
40.00	**90.06**	**61.54**	**46.35**
50.00	**96.87**	**76.92**	**25.94**
60.00	**105.29**	**92.31**	**14.06**
70.00	**115.08**	**107.69**	**6.86**

The figure below illustrates the relationship between the bond's premium and the underlying share price.



As the share price trades down the convertible loses value but is supported by the fact that, even if the conversion option is worth nothing, the bond still has a value as a 3.75% straight bond.

Equity value: the market value of the equity embedded in the convertible
- i.e. its parity.

Bond value: the market value of the convertible as a straight fixed income instrument. Also known as: **Investment value**.

- As the shares trade down the bond is supported by its **bond value** (the horizontal line)
- As the shares trade up the bond is supported by its **equity value** (the parity line)

Convertibles trade at the higher of their pure bond or pure equity values.

g) Restore the equity price back to $60.00. Other things being equal, which of the following statements are true?

- [x] Higher dividend growth reduces the bond's income advantage
- [ ] Higher dividend growth reduces the bond's parity
- [ ] Higher dividend growth increases the bond's premium
- [x] Higher dividend growth reduces the convertible's price

Explanation

- **Higher dividend growth reduces the bond's income advantage**
- **Higher dividend growth reduces the convertible's price**

This is true if other things are equal. In practice, higher dividend growth projections have a positive influence on the share price, which may drive up the bond price.

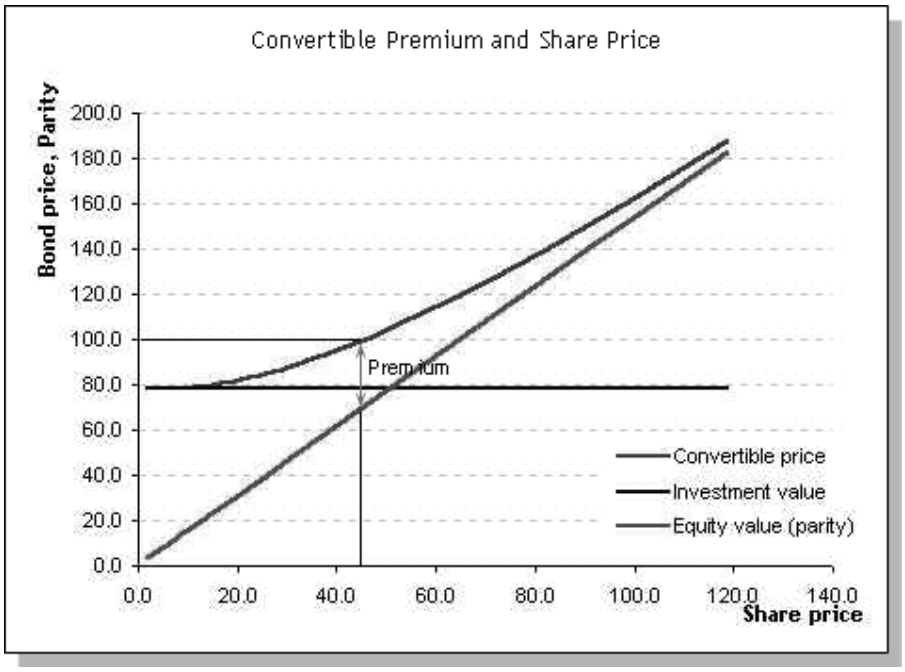
h) Restore the dividend growth back to 15.00%, and the share price back to $60. We shall now explore how changes in bond yields affect the convertible's price and its premium. Entering the indicated values for the yield on the benchmark bond, complete the table below.

Benchmark Yield	Convertible Bond Price	Parity	Premium
4.00%	116.9	92.31	26.67
5.00%	110.6	92.31	19.85
6.00%	105.2	92.31	14.06

Explanation

Benchmark Yield	Convertible Bond Price	Parity	Premium
4.00%	**116.93**	**92.31**	**26.67**
5.00%	**110.63**	**92.31**	**19.85**
6.00%	**105.29**	**92.31**	**14.06**

The figure below illustrates the relationship between the convertible's price, its premium and market yields.



As yields rise, the prices of all bonds - including convertibles - fall. Convertibles which trade with low parity values are more sensitive to changes in market yields.

i) Which one or more of the statements below would correctly describe your exposure if you had a long position in this convertible?

- ☑ Long vega with respect to the equity
- ☑ Short rho
- ☑ Short psi
- ☑ Long delta with respect to the equity

Explanation

	Explored above in:
Long vega with respect to the equity	(c)
Long delta with respect to the equity	(e)
Short psi	(f)
Short rho	(g)

3. OTC Structures

Question 1

An investment brochure published by a UK life assurance company reads as follows:

Are UK equities markets vulnerable?
Are you dissatisfied with the low yields available on fixed income investments?

The Guaranteed Index Bond (GIB) gives you an opportunity to participate in the rise of the FT-SE 100 index of UK stocks, but with 100% guarantee on your capital.

The GIB works like this:

- You purchase GIB certificates with a maturity of 5 years
- At maturity:
  - If the FT-SE rose you earn the rise in the index
  - If the FT-SE fell we return your capital in full

a) What are the main components embedded in this product?

- ☐ The investor is long a physically-settled call option on the FT-SE index
- ☑ The investor is long a zero-coupon bond
- ☐ The investor is long a par bond
- ☑ The investor is long a cash-settled call on the FT-SE index

Explanation

- **The investor is long a zero-coupon bond**
  The GIB does not pay any interest or dividend during the term. Any interest on the bond is used to pay for the options on the equity market.
- **The investor is long a cash-settled call on the FT-SE index**
  The investor receives the gains on the index in cash rather than in shares.

b) If the 5 year yield (annually compounded) is 6.40%:

(i) For an investment of GBP 3,000.00, how much would be allocated to the purchase of the zero-coupon bond (to the nearest £5)?

GBP 2200

(ii) Therefore, how much would be left over to purchase the options?

GBP 800

Type in your figures in each box and validate.

Explanation

(i) The amount allocated to the zero-coupon bond would be the present value of GBP 3,000, payable in 5 years, discounted at 6.40%:

= 3,000 / (1 + 0.064)
= GBP 2,199.95 or GBP **2,200**, rounded.

(ii) Therefore, this leaves GBP **800** (= 3,000 – 2,200) for the purchase of the options.

c) Using an option pricing model (click on spreadsheet on left to launch), we shall now calculate the size of the option contract that could be purchased with the money calculated in (b)(ii).

In the pricing model, enter the following **Market data**:

Spot	6,342
Strike	6,342
Expiry (yrs)	5
Funding rate	6.40%
Yield	2.43%
Volatility	19%

What is the calculated option price? 1456

(to the nearest index point)

Now close the option pricing model and calculate the contract size as follows:

Payoff in GBP per index point (to the nearest pence) = $\frac{\text{Answer to question (b)(ii)}}{\text{Option price in index points}}$

= 0.55

Explanation

Option price: **1,456** index points

Option payoff: GBP **0.55**

d) Next, we explore the payoff of this structure at maturity for different levels of the FT-SE. Using the results of part (c), complete the table below, which compares the maturity value of GBP 3,000 invested in the GIB with the value of an equivalent equity index portfolio. Enter your figures to the nearest pound.

FTSE Index	Value of GIB Investment			Value of FT-SE Portfolio
	Zero-coupon bond	Option	Net	
5342	3,000	0	3000	2527
6342	3,000	0	3000	3000
7342	3,000	550	3550	3473
8342	3,000	1100	4100	3946

Explanation

FTSE Index	Value of GIB Investment			Value of FT-SE Portfolio
	Zero-coupon bond	Option	Net	
5342	3,000	**0**	**3,000**	**2,527**
6342	3,000	**0**	**3,000**	**3,000**
7342	3,000	**550**	**3,550**	**3,473**
8342	3,000	**1,100**	**4,100**	**3,946**

e) The GIB appears to outperform the equity portfolio under all market scenarios. Where's the catch? (One or more answers may be true.)

- ☐ There is no catch
- ☑ The GIB pays no interest
- ☑ The return on the equity portfolio should also include dividends!
- ☐ The options are too cheap!

Explanation
The return on the equity portfolio should also include dividends!
Assuming a constant dividend yield of 2.43% per annum, over a period of 5 years an equity fund should earn:

Dividends $= 3{,}000 \times (1 + 0.0243)^5 - 3{,}000$

= GBP 383, or more if the underlying index rises

On this basis for the GIB to outperform a straight equity investment the FT-SE would have to:

- Either rise by at least some 2,500 points, or
- Fall by at least some 800 points

The GIB pays no interest.
At the assumed rate of 6.40% (annually compounded) an investment of GBP 3,000 for 5 years would return:

$3{,}000 \times (1 + 0.064)^5$
= GBP 4,091 (rounded)

So the FT-SE would have to rise by at least some 2,000 from its current level for the GIB to outperform this simple alternative!

f) What type of investor might be interested in this security?

- ☑ A very bullish investor who also perceived a lot of risk in the equity markets
- ☐ An investor who believed the equity market will remain subdued
- ☐ A very bearish investor
- ☐ A very bullish investor

Explanation
A very bullish investor who also perceived a lot of risk in the equity markets.

If the investor did not perceive a lot of downside risk they might as well purchase straight equities; if they were not very bullish they might be better off placing the money in a fixed income security.

g) The issuer is considering embedding one of the following call options to protect the gains on the index made during the life of the GIB, in case there was a last-minute drop in the equity market:

A: A ladder structure (see Barrier Options)
B: A cliquet structure (see Forward Options)
C: An up-and-out barrier call (see Barrier Options)
D: An average price (see Asian Options)

Which of these would *not* be relevant? C

Which of these is likely to be cheapest? (in terms of premium cost) D

Explanation

Which of these would not be relevant? **C: An up-and-out barrier call**

An up-and-out call would destroy all the gains achieved if the index went through the barrier!

Which of these is likely to be cheapest? (in terms of premium cost) **D: An average price (Asian) call**

In an Asian price option the underlying is an average of the market prices and the volatility of an average is typically much lower than the volatility of the underlying price series

h) The issuer of the GIB is exposed to movements in the FT-SE. Which (one or more) of the following strategies could they use to hedge that risk?

- [x] Delta hedge using index futures
- [x] Delta hedge with an index portfolio
- [ ] Buy an identical put option from an investment bank
- [x] Buy an identical call option from an investment bank

Explanation

- **Delta hedge using index futures**
- **Delta hedge with an index portfolio**

  One drawback of using cash equities rather than futures is that the issuer might need to tie up a substantial part of the issue proceeds to fund the delta hedge.

- **Buy an identical call option from an investment bank**

  More often than not the issuer does not have an interest in managing the options risk, so they typically buy back the same options from the investment bank which advised on the issue

Question 2

A brochure from a top-name French bank reads as follows:

Are you dissatisfied with the current low yields on fixed income investments?
Do you find current equity valuations too high?

Cash-or-Shares is an investment that is linked to the performance of Groupe Bouygues, one of France's hottest stocks. It gives you an opportunity to earn above-average returns and at the same time acquire a blue-chip stock for your core equity portfolio at a 12% discount to the current market.

Cash-or-Shares works as follows:

- You purchase *Cash-or-Shares* certificates with a maturity of 12 months. During this time you earn EURIBOR + 150 basis points: much more than the current market!
- At maturity:
  - If the price of Bouygues common stock trades above EUR 181.82 you receive your principal in full
  - If the price of Bouygues trades below EUR 181.82 you receive 55 Bouygues shares for every EUR 10,000 you invested

a) If 12 month EURIBOR is 3.30% calculate below the yield to an investor under the following price scenarios for the underlying shares. Please enter answers to 2 decimal places.

Bouygues Share Price	Interest (%)	Capital Gain/loss on the Principal	Net Yield (%)
171.82	3.30 + 1.50 = 4.80	-5.50	-0.70
176.82	4.80	-2.75	2.05
181.82	4.80	0.00	4.80
186.82	4.80	0.00	4.80
191.82	4.80	0.00	4.80

Explanation

Bouygues Share Price	Interest (%)	Capital Gain/loss on the Principal	Net Yield (%)
171.82	3.30 + 1.50 = 4.80	**-5.50**	**-0.70**
176.82	4.80	**-2.75**	**+2.05**
181.82	4.80	**0.00**	**+4.80**
186.82	4.80	**0.00**	**+4.80**
191.82	4.80	**0.00**	**+4.80**

b) What are the main components embedded in this product?

- [x] The investor is short puts on the shares
- [ ] The investor is long a zero-coupon bond
- [ ] The investor is short calls on the shares
- [x] The investor is long a par bond

Explanation

- **The investor is long a par bond**.
  The underlying fixed income security pays EURIBOR.
- **The investor is short puts on the shares**.
  The investor has an obligation to receive shares at EUR 181.82 if their price falls below this level. For these options the investor receives an extra 1.50% over LIBOR.

c) What is the premium per share effectively received for the options sold?

EUR 2.73

Explanation
What is the premium per share effectively received for the options sold?

Premium earned on a EUR 10,000 investment:

$$= \frac{10{,}000 \times 0.0150}{55}$$

= EUR **2.73**