1.FRA

1. [10 points] I

Money market rates:

6-month	4.000% – 4.125%	180 days
12-month	4.375% - 4.500%	360 days

a. [5 points] Calculate the highest **6 v 12** FRA price, above which it is possible to make a risk-free profit.

Consider

i. Borrow $100 for 12 months at 4.5%

ii. Lend $100 for 6 months at 4%

iii. Sell FRA 6 v 12 at I

$$\left(\frac{100\times\left(1+4.5\%\times\frac{360}{360}\right)}{100\times\left(1+4\%\times\frac{180}{360}\right)}-1\right)\times\frac{360}{180}=4.90196\%$$

b. [5 points] Calculate the lowest **6 v 12** FRA price, below which it is possible to make a risk-free profit.

Consider

i. Lend $100 for 12 months at 4.375%

ii. Borrow $100 for 6 months at 4.125%

iii. Buy FRA 6 v 12 at

$$\left(\frac{100\times\left(1+4.375\%\times\frac{360}{360}\right)}{100\times\left(1+4.125\%\times\frac{180}{360}\right)}-1\right)\times\frac{360}{180}=4.531537\%$$ I

2.IRS (Cashflows of the float leg&NVP)

2. [20 points] Value the following IRS on 27 March 2002

Notional amount:	10 million
Start of swap:	23 July 2001
Maturity of swap:	23 July 2004 (Note that 2004 is a leap year)
Receive:	7.3% (semi-annual 30/360)
Pay:	LIBOR (semi-annual ACT/360)
Previous LIBOR fixing:	9.2% from 23 Jan 2002 to 23 Jul 2002

Zero-coupon discount factors from 27 Mar 2002:

23 Jul 2002:	0.9703	23 Jan 2003:	0.9249
23 Jul 2003:	0.8825	23 Jan 2004:	0.8415
23 Jul 2004:	0.8010		

a. [5 points] Show the cashflows of the fixed leg.

23 Jul 2002	$10{,}000{,}000 \times 7.3\% \times \frac{180}{360}$	$= 365{,}000$
23 Jan 2003	$10{,}000{,}000 \times 7.3\% \times \frac{180}{360}$	$= 365{,}000$
23 Jul 2003	$10{,}000{,}000 \times 7.3\% \times \frac{180}{360}$	$= 365{,}000$
23 Jan 2004	$10{,}000{,}000 \times 7.3\% \times \frac{180}{360}$	$= 365{,}000$
23 Jul 2004	$10{,}000{,}000 \times 7.3\% \times \frac{180}{360}$	$= 365{,}000$

b. [5 points] From the zero-coupon discount factors, infer the market rates for the float-leg periods.

23 Jul 2002	23 Jan 2003	$\left(\frac{0.9703}{0.9249} - 1\right) \times \frac{360}{184}$	$= 0.096039$
23 Jan 2003	23 Jul 2003	$\left(\frac{0.9249}{0.8825} - 1\right) \times \frac{360}{181}$	$= 0.09556$
23 Jul 2003	23 Jan 2004	$\left(\frac{0.8825}{0.8415} - 1\right) \times \frac{360}{184}$	$= 0.095327$
23 Jan 2004	23 Jul 2004	$\left(\frac{0.8415}{0.8010} - 1\right) \times \frac{360}{182}$	$= 0.100012$

c. [5 points] Using the market rates inferred in part b, calculate the cashflows of the float leg.

23 Jul 2002 $-10{,}000{,}000 \times 9.2\% \times \frac{181}{360} = -462555.56$

23 Jan 2003 $-10{,}000{,}000 \times 9.6039\% \times \frac{184}{360} = -490863.88$

23 Jul 2003 $-10{,}000{,}000 \times 9.556\% \times \frac{181}{360} = -480453.26$

23 Jan 2004 $-10{,}000{,}000 \times 9.5327\% \times \frac{184}{360} = -487225.19$

23 Jul 2004 $-10{,}000{,}000 \times 10.0012\% \times \frac{182}{360} = -505617.98$

d. [5 points] Calculate the NPV.

	Fixed	Floated	Df	
23-Jul-02	365000	-462555.56	0.9703	-94658.16
23-Jan-03	365000	-490863.88	0.9249	116411.50
23-Jul-03	365000	-480453.26	0.8825	101887.50
23-Jan-04	365000	-487225.19	0.8415	102852.50
23-Jul-04	365000	-505617.98	0.801	112635.00
				528444.66

3.Curve &Discount factor&swap

3. [35 points] Curve Construction:

Given the following market data input and WEL calendar (note that Saturdays are not business days):

Currency	NZD
Base Date	1-May-06
Days to Spot	2
Cash Basis	ACT/365
Futures Basis	ACT/365
Swaps Basis	ACT/365
Swaps Freq	Semi-Annually
Holiday	WEL

Cash	ON	7.25000%
Cash	TN	7.25000%
Cash	3M	7.50500%

Futures	15-Jun-06	92.57
Futures	14-Sep-06	92.72
Futures	14-Dec-06	93.00

Swaps	1Y	7.27600%

a. [10 points] Identify the dates for the Cash key points and calculate the discount factor for the key points.

2-May-06 $$\frac{1}{1+\left(0.0725\times\frac{1}{365}\right)}=0.999801409$$

3-May-06 $$\frac{0.99801409}{1+\left(0.0725\times\frac{1}{365}\right)}=0.99960285$$

3-Aug-06 $$\frac{0.99602858}{1+\left(0.07505\times\frac{92}{365}\right)}=0.98104471$$

b. [5 points] Identify the starting future date and use exponential interpolation to calculate the discount factor for the starting future date.

15-Jun-06 $$0.99960285\times\left(\frac{0.98104471}{0.99960285}\right)^{\frac{42}{92}}=0.99088564$$

c. [10 points] Identify the dates of key points for all futures and calculate the discount factor for all Futures key points. Given 15 Mar 07 is the date for the last futures key point.

14-Sep-06 $$\frac{0.99088568}{1+\left((100-92.57)\times\frac{91}{365}\right)}=0.97286420$$

14-Dec-06 $$\frac{0.97286420}{1+\left(\left(\frac{100-92.72}{100}\right)\times\frac{91}{365}\right)}=0.95552136$$

15-Mar-07 $$\frac{0.95552136}{1+\left(\left(\frac{100-93}{100}\right)\times\frac{91}{365}\right)}=0.93913158$$

d. [2 points] Identify the date of the key point for the 1Y Swaps.

3-May-07

e. [6 points] Show the equation that the 1Y Swaps has to satisfy.

$$\left(-100\times 0.99960285\right)+\left(100\times 7.27\%\times\frac{184}{365}\times 0.96329656\right)$$
$$+\left(100+100\times 7.27\%\times\frac{181}{365}\times D\right)=0$$

f. [2 points] Calculate the discount factor for the 1Y Swaps key point. (Hint: there is only ONE unknown in the equation).

0.93913158

4.VBA

4. [10 points] Transfer VBA data to and from Worksheet

Given an array with data as follows:

```
Dim dArray(1, 3) As Double
dArray(0, 0) = 1:   dArray(0, 1) = 2:   dArray(0, 2) = 3
dArray(1, 0) = 4:   dArray(1, 1) = 5:   dArray(1, 2) = 6
```

a. [3 points] Write one statement to transfer the array to the range B2:D3.

```
Range("B2:D3") = dArray
```

b. [2 points] Write one statement to clear dArray, that is, fill dArray with 0s.

```
Erase dArray
```

c. [5 points] Write code to transfer data from "data2x3", a 2 x 3 named range to dArray.

```
For i = 0 To 1
    For j = 0 To 2
        dArray(i, j) = Range("data2x3").Cells(i + 1, j + 1)
    Next j
Next i
```

5.T&F

5. [10 points] True or False:

a. [2 points] In an IRS, one party will gain while the other will lose.

F

b. [2 points] Given a 5% nominal interest rate quoted for a 1-year deposit when the interest is paid all at maturity. The quarterly equivalent rate should be less than 5%.

T

c. [2 points] A zero coupon instrument A is quoted at a discount basis of 5%. Another zero coupon instrument B is quoted at a yield basis of 5% with the same maturity as A. Instrument B has a better return.

F

d. [2 points] If a trader sells an FRA to a counterparty, he should buy futures to cover his position.

F

e. [2 points] A flat yield curve indicates that interest rates will drop in the future.

T

6.excel

6. [5 points] Excel

a. [2 points] Formula

	A	B	C
1	Notional	$1,000,000	
2	Spot Date	12-Mar-07	
3	Swaps Basis	ACT/365	
4	Swaps Freq	Semi-Annually	
5			
6	Swaps	3Y	1.05625%
7			
8	Date	Day Count	Received Leg Fixed Cashflow
9	12-Mar-07		
10	12-Sep-07	184	
11	12-Mar-08	182	
12	12-Sep-08	184	
13	12-Mar-09	181	
14	14-Sep-09	186	
15	12-Mar-10	179	

Show the formula for the received leg fixed cashflow for 12-Sep-07. Your formula should be able to copy and paste to the rest of the cashflows.

Show the formula for the received leg fixed cashflow for 12-Sep-07. Your formula should be able to copy and paste to the rest of the cashflows.

=B1 * C6 * B10 / 365

b. [3 points] Function

Given the following PMT function description from Excel:

PMT(rate,nper,pv)

Rate is the interest rate for the loan.

Nper is the total number of payments for the loan.

Pv is the present value, or the total amount that a series of future payments is worth now; also known as the principal.

For a home loan of $3,000,000 and an annual rate of 5%, express, in terms of PMT, the monthly payment for a loan term of 20 years.

PMT(5%/12, 240, 3000000)