Part I: Problems.

There are 4 problems: Total points in Part I is 85

Question 1 (Binary Options) (20 points)

Suppose you have a portfolio that consists of

- a long position in an asset or nothing call with strike price 30,
- a long position in a cash or nothing call with strike and cash reward equal to 30.
- a short position in an asset or nothing call with strike price 50,

The underlying stock and the expiration date for all these options are the same.

What is the payoff from this portfolio if at the expiration date the stock price turns out to be 35?

(Do NOT include the initial cost of creating this portfolio).
**Question 2 (Shout Option) (30 POINTS)**

Consider a call option on a stock where the holder can shout once before expiration. The call option will expire in 6 months. The strike price of the call option is $30. Assume that the 3-month risk free interest rate is zero %. The stock price will follow the two-step binomial tree in the course of the next 6 months.

![Binary Tree Diagram]

a) Suppose the holder shouts at 40. What is the value of the call option at price 60? (10 points)
b) Suppose the holder shouts at 40. What is the value of the call option at price 40? (10 points)

c) Suppose the holder DOES NOT shout at 40. What is the value of the call option at 60? (10 points)
**Problem 3 (20 points)**

If the following two portfolios contain the same delta points, what should be the number of call options contracts $N$ in portfolio A?

**Portfolio A:** 200 shares of IBM and $N$ call option contracts on IBM (each contract contains 100 call options) with call delta 0.400.

**Portfolio B:** 400 shares of IBM and 20 short put option contracts on IBM (each contract contains 100 put options) with put delta -0.500.

**Problem 4 (15 points)**

If the following portfolio has 2350 delta points, what should be the number of put options contracts $N$ in the portfolio?

- 2000 shares of MER stock.
- 30 long call option contracts on MER (each call contract contains 100 call options) with call delta 0.25.
- $N$ long put option contracts on MER (each put contract contains 100 put options) with put delta -0.40.
PART II

Multiple Choice Questions (5 points each-Total of 15 points)

1) **Duration MATCHING**

Consider a bank with the following balance sheet

<table>
<thead>
<tr>
<th>Assets</th>
<th>Value</th>
<th>Duration of the Asset</th>
</tr>
</thead>
<tbody>
<tr>
<td>6yr loan @5%</td>
<td>$10,000</td>
<td>4</td>
</tr>
<tr>
<td>10 yr loan @5%</td>
<td>$10,000</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total Asset Value</strong></td>
<td>$20,000</td>
<td></td>
</tr>
</tbody>
</table>

Accordingly, duration of the asset side is equal to 6.

<table>
<thead>
<tr>
<th>Liabilities</th>
<th>Value</th>
<th>Duration of the Liability</th>
</tr>
</thead>
<tbody>
<tr>
<td>10yr loan @ Libor</td>
<td>$10,000</td>
<td>3</td>
</tr>
<tr>
<td>6yr loan @5%</td>
<td>$10,000</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total Liability</strong></td>
<td>$20,000</td>
<td></td>
</tr>
</tbody>
</table>

Accordingly, duration of the liability side is equal to 4.

Suppose the portfolio manager wants to reduce the duration gap to zero and thus immunize all interest rate risk. For that purpose he wants to swap $x$ of the 10yr loan @ Libor with a 10yr loan at 7% fixed rate. The duration of the fixed rate 10yr loan at 7% is 8.

The size of the swap x that reduces the duration gap to zero is

A) 5000
B) 6000
C) 7000
D) 8000
E) 9000

Answer:.........................
**Question 2: Bull Spread**

Suppose you created a bull spread, which is composed of

- A long position in a call option on gold for a price of $10 and with a strike price of $50 and
- A short position in a call option on gold for $5 with a strike price of $70.

Find the payoff from this bull spread if the gold price at the expiration date turns out to be $S_T=60$, **including the initial cost of creating the position which is equal to $-10+5 = -5$**.

A) 5  
B) 30  
C) -15  
D) 0  
E) 20

Answer:……………………

**Question 3 (Arbitrage when put-call parity does not hold)**

Consider a call option and a put option on a stock, each with a strike price of $X=$22. The price of the call option is $4 and the price of the put is $3. Both options have 6 months until expiration and the 6-month risk free rate of interest is 10%. The current stock price is $20.

What is the arbitrage profit for $S_T=60$?

A) 1.1  
B) 3  
C) 3.5  
D) 6.5  
E) 0

Answer:……………………