

**The University of Hong Kong**  
**FACULTY OF ENGINEERING**  
**DEPARTMENT OF COMPUTER SCIENCE**

**COMP 7802 Introduction to financial computing**

**Date:** December 18, 2021

**Time:** 2:30pm–4:30pm

**Time allowed** : 2 hours

**Student I.D.** : \_\_\_\_\_

*Only approved calculators as announced by the Examinations Secretary can be used in this examination. It is candidates' responsibility to ensure that their calculator operates satisfactorily, and candidates must record the name and type of the calculator used on the front page of the examination script.*

**Brand and type**

**of calculator** : \_\_\_\_\_

*Candidates are permitted to bring to the examination one piece of A4-sized paper with printed or written notes on both sides.*

**Answer ALL questions.**

1. [30 points]

Given an investment product:

1. Buyer will pay a monthly premium for a number of months.
2. The premium paid will earn interest. The rate is the Zero Coupon Rate  
Zero Coupon Rate has the same definition as presented in Yield Curve Lecture.
3. Starting the next month after the last payment,  
buyer will start receiving an amount at the end of each month for a number of months.

Note: 1. Interest will continue to be earned throughout the investment and payout periods.

2. The final balance should be as close to zero as possible.

3. All Payment Date and Payout Date should follow the Modified Following convention with End-End rule applied.

1st Payment Date

October 29, 2021

Payout Amount

\$10,000

Payout Period

3 Months

Zero Coupon Rate

3.00%

Investment Period

3 Months

Yearly Basis

365

No.	Payment Date	Payment Amount	Accrued Amount
1	(a)	(g)	(g)
2	(b)	(g)	(h)
3	(c)	(g)	(i)

Payout Date	Payout Amount	Remaining Balance
(d)	10,000.00	(j)
(e)	10,000.00	(k)
(f)	10,000.00	(l)

[1 points each] (a) through (f)

[10 points] (g)

[3 points each] (h) through (k)

[2 points] (l)

**Holiday Information:**

Assume no non-weekend holidays from 1<sup>st</sup> October 2021 to 31<sup>st</sup> May 2022 and  
October 29 2021 is a Friday

Show your work. You can work on the parts in any order.

But please summarize your results in alphabetical order from (a) to (l).

2. [20 points] An FRA market maker sells a EUR 100 million 3v6 FRA at a rate of 7.52%. He is exposed to the risk that interest rates will have risen by the FRA settlement date in three months' time.

Date (spot)	21 December
3v6 FRA rate	7.52%
March futures price	92.50
Current 3M spot rate	6.85%

The dealer needs to calculate a hedge ratio. Assume 30/360, that is, 90/360 for 3 months.

- a. [5 points] If interest rate for the FRA period rises by 1 bp (basis point), calculate the loss to the dealer, discounting back to the spot day.
- b. [3 points] Should the dealer buy or sell future contracts to hedge the FRA?
- c. [5 points] Given the following specification for the Three Month Euro (Euribor) Future

Notional	€1,000,000
Minimum Tick Size	0.5 bp

Calculate the hedge ratio. Show your expression.

- d. [7 points] Continued from c), after hedged with Futures, market data after 3 months as follows:

Date (spot)	21 March
March futures settlement	92.38
3M spot rate	7.625%

Calculate the P/L (Profit and Loss).

3. [20 marks] Below are the current market data for stock option of Company ABC in Stock Exchange.

Today = T

Current Stock price on T (\$) : **21.35**

Day Count Convention : Act / 360

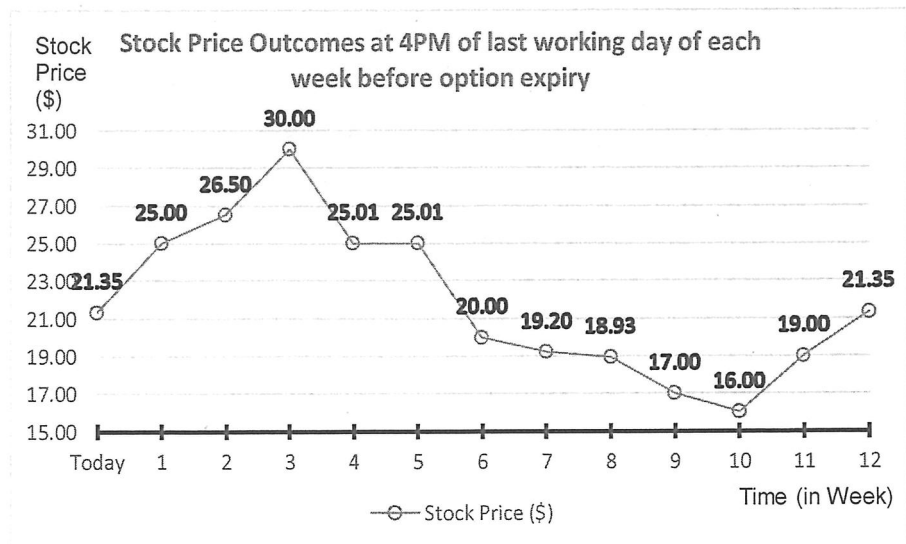
Stock Option Style = American

Stock option conversion ratio: 1 option = 1 share

Call/Put	Time to Expiry	Strike	Price (\$)
Call	90 days	23.00	0.80
Put	90 days	21.00	1.25

- a) [8 points] Please (i) indicate the moneyness and (ii) compute the time value of above 2 options? Show all your calculation clearly.
- b) [3 points] Based on the given market data, investor would like to execute 1 unit of long Strangle strategy on T, please (i) list out the buy/sell of respective option(s) in the market to construct this strategy, (ii) the cost of constructing this strategy and (iii) explain the expectation of this strategy deployment.
- c) [9 points] After investor had constructed the 1 unit long Strangle strategy on T, the observed stock price outcomes at 4PM of last working day of each week before option expiry shown in below.

Week	Stock Price (\$)
Today	21.35
1	25.00
2	26.50
3	30.00
4	25.01
5	25.01
6	20.00
7	19.20
8	18.93
9	17.00
10	16.00
11	19.00
12	21.35



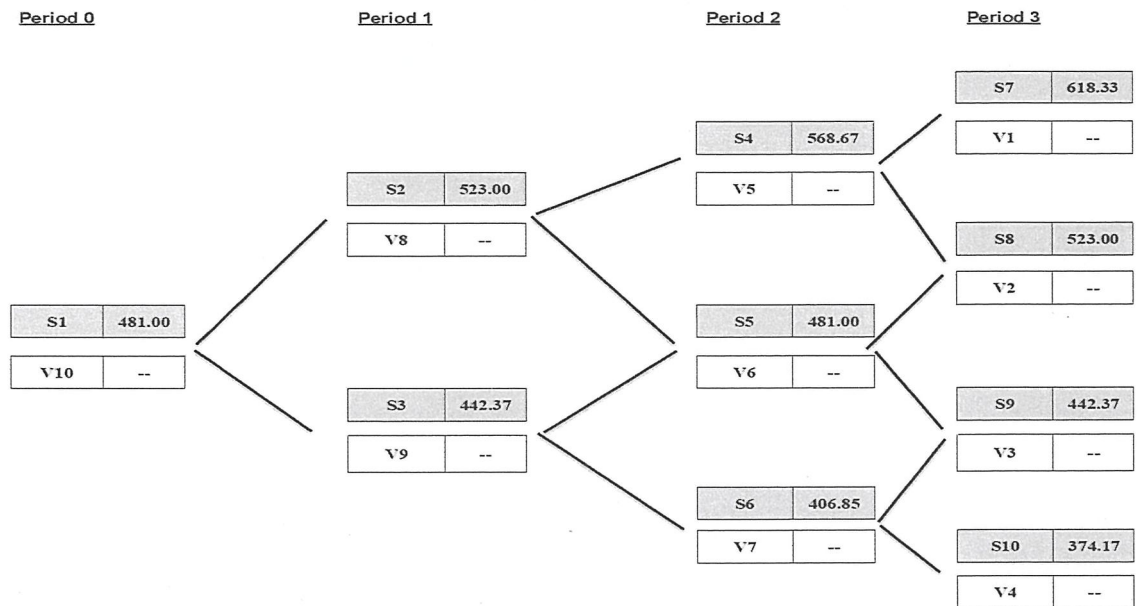
Based on the above observed stock price outcomes of each week, please indicate which week(s) the investor could close out his long Strangle position with profit via option exercising at 4PM? Please show your calculation clearly to justify your choice(s).

(Assumption: The Stock Exchange rule is that American stock option can be exercised at any time before option market closing 5PM daily. Ignore the transaction cost.)

4. [30 marks] Below information is the current market data for stock and stock option of Company ABC.

Current Stock price = \$481 per share  
 Option Strike = \$490  
 Option time to expiry = 90 days  
 Stock Option Style = European  
 Day count convention = ACT/360  
 Annualized Volatility = 29%  
 Continuous compounding risk-free interest rate = 1.25% per annum

The research student developed below tree diagram of 3-periods binomial option pricing model (Cox, Ross & Rubinstein) to calculate the European option theoretical price.



Where:  
 S1-S10 = Stock Value Projection at different period node  
 V1-V10 = Option Value at different period node

- a) [5 points] Please calculate below intermediary parameters of binomial option pricing model.

- $\Delta t$  = period interval in each binomial nodes
- DF = discount factor in each binomial nodes
- u = up jump size
- d = down jump size
- p = risk neutral probability of up jump size

Please show the calculation expression of each intermediary parameters with result in 6 decimal points accuracy.

- b) [11 points] Based on the Stock Value Projection result given in the tree diagram, please compute the European call option theoretical price.

- please show all your calculation to derive the value of V1 to V10; and
- indicate the European call option price result clearly.

Show the calculation expression with result in 6 decimal points accuracy.



c) **[11 marks]** Continued from b), applying the same tree diagram, please compute the European put option price.

- please show all your calculation to derive the value of  $V_1$  to  $V_{10}$ ; and
- indicate the European put option theoretical price result clearly.

*Show the calculation expression with result in 6 decimal points accuracy.*

d) **[3 marks]** Please demonstrate how you validate your computed put and call option theoretical price above are valid?

*Show your validation answer with 2 decimal points accuracy will be sufficient.*

—END OF PAPER—