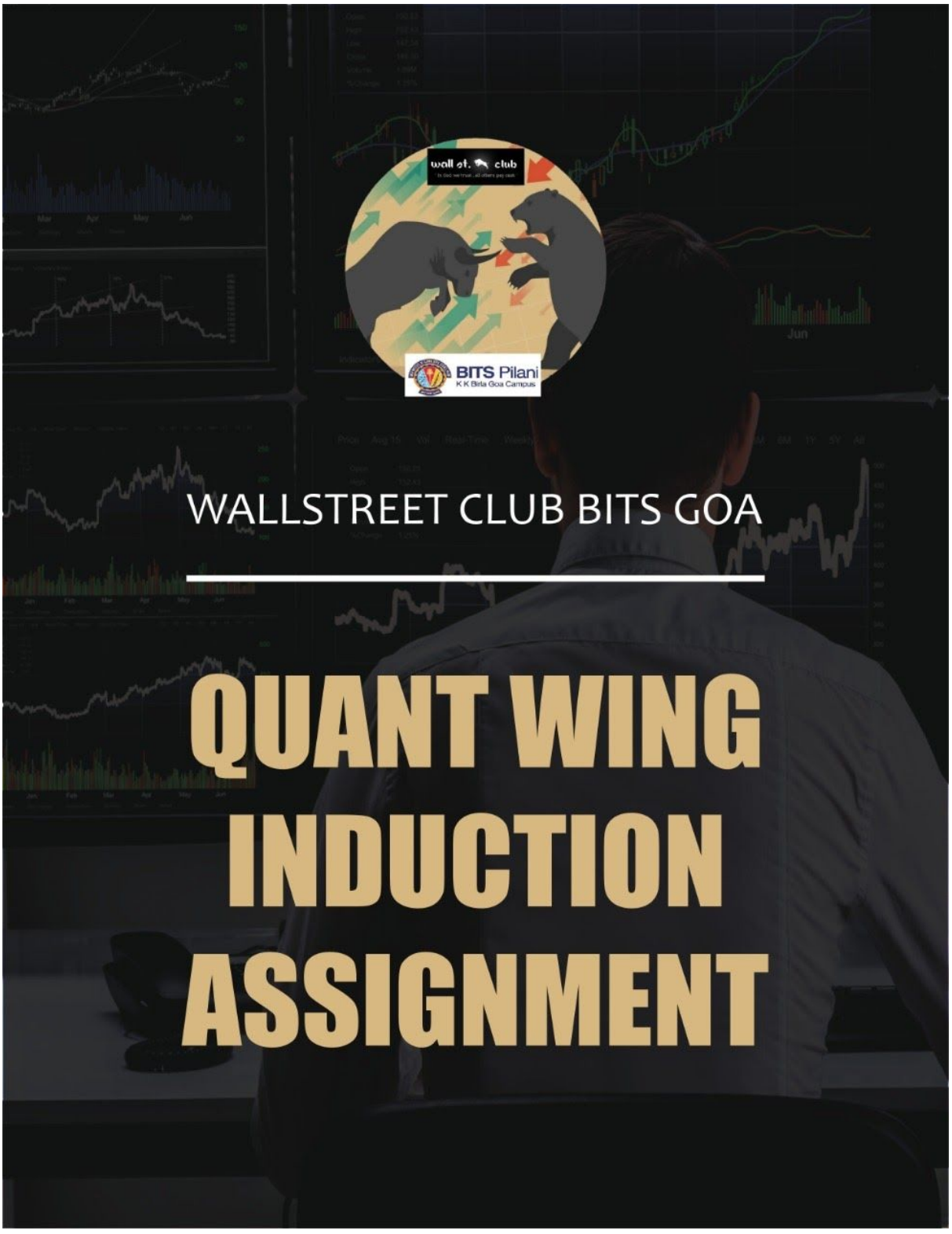

wall st. club
BITS Pilani
K K Birla Goa Campus
WALLSTREET CLUB BITS GOA
QUANT WING
INDUCTION
ASSIGNMENT

Hey!

We are glad to see that you're interested in attempting the assignment, or have just scrolled past the cover page. Either way, we are glad.

Before proceeding, please fill up this 2 question form. We would like to use this for simple data collection.

https://forms.gle/8aE3yk2EQuouPwwm8

Please attempt this assignment even if you are interested in Competitive Coding, Machine Learning or Finance in general. All these are fields important to Quant Finance!

Why attempt this assignment?

1. You will get to work on 1 huge quant software based project once you are a member of the quant wing. Projects like this one can add real value to your resume. (More on this once you are inducted)
2. Micro challenges throughout the year open to the quant wing only with actual cash and pizzas to be won (It is part of Wall Street Club after all)
3. Obviously, you will meet like minded people with similar agenda and career paths which will help you grow yourself.

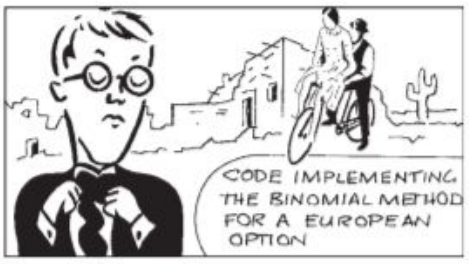
Guidelines:

1. You will probably find a lot of unfamiliar concepts in the questions. However, that should not stop you from attempting the questions. We will try to link as many resources in the questions as we can to help you out, however remember to **Google your queries.** Even if you have 0 knowledge, please try and google everything and you shall understand.
2. No need to attempt and submit all 3 questions. Even if you have completed 10% of the whole assignment, please do make a submission. This is how everyone starts out.
3. Try and not copy each other's code. It is fine if you use online resources and refer to code available online but make sure you understand each and every thing you are writing.
4. There are **3 questions** with different weightage each. Make sure to read all 3 and implement them in **Python.**
5. You might see some jargons that you might not understand in that case:

Feel free to contact **Aditya Aryan** at **+919654423981** for any queries and doubts whatsoever.

Question 1

Code up a simulation of the **Binomial Asset Pricing Model (BAPM) on Python**. To attempt this you will have to read about what it actually is. To get an in depth reading, check out **Chapter 3 of the book Paul Wilmott Introduces Quantitative Finance**. If you are looking for direct implementation, here is something that should help you:




```
Function Price(Asset As Double, Volatility _
                        As Double, IntRate _
                        As Double, Strike _
                        As Double, Expiry _
                        As Double, NoSteps _
                        As Integer)
ReDim S(0 To NoSteps)
ReDim V(0 To NoSteps)
time step = Expiry / NoSteps
DiscountFactor = Exp(-IntRate * time step)
temp1 = Exp((IntRate + Volatility * Volatility) _
                                        * time step)
temp2 = 0.5 * (DiscountFactor + temp1)
u = temp2 + Sqr(temp2 * temp2 - 1)
d = 1 / u
p = (Exp(IntRate * time step) - d) / (u - d)

S(0) = Asset
For n = 1 To NoSteps
    For j = n To 1 Step -1
        S(j) = u * S(j - 1)
    Next j
        S(0) = d * S(0)
Next n

For j = 0 To NoSteps
    V(j) = Payoff(S(j), Strike)
Next j

For n = NoSteps To 1 Step -1
    For j = 0 To n - 1
        V(j) = (p * V(j + 1) + (1 - p) * V(j)) _
            * DiscountFactor
    Next j
Next n
Price = V(0)
End Function
```

Working code

Source: Paul Wilmott Introduces Quantitative Finance

This is essentially a pseudocode of the implementation. If you are confident try and simply emulate this whilst understanding it too!

Question 2

Come up with a simple trading strategy and create a backtester in Python using technical indicators. If you have attended the lectures last year you should know what a technical indicators is and how they work, if not, check this out:
https://www.investopedia.com/terms/t/technicalindicator.asp
You are free to choose the ticker and the time frame that you would want to backtest your strategy on. Here is a link to a demo backtester:https://www.pythonforfinance.net/2017/07/31/bollinger-band-trading-strategy-backtest-in-python/
Your model will be judged on innovation and scalability besides, obviously the Profit and Loss graph. (Feel free to flex any knowledge you have about machine learning algorithms to make strategies too)

Question 3

This problem is basically a ‘portfolio optimisation’ problem. The idea as to why one has a diverse portfolio is so that you are protected in all scenarios.
Suppose you have a list of 20 stocks, you are supposed to choose the 5 most unrelated stocks on the basis of their returns. Ex. you will probably expect companies like Coca-Cola and Pepsi to have correlated returns which means you will earn a loss on both together if the industry goes and vice versa. Therefore, it is best to select one of those 2 and have a diverse portfolio instead.

Choose the top 20 stocks of NASDAQ according to their market (https://www.investopedia.com/articles/investing/053116/10-largest-holdings-sp-500-aaplamznfb.asp) and write a code to select the 5 most uncorrelated stocks based on their returns.

There are numerous ways to solve this problem to start, have a look at Markowitz Efficient Frontier:
(https://www.investopedia.com/terms/e/efficientfrontier.asp)

Submission Instructions:

Create a GitHub Repository called Quant-Wing-2020, fill this google form: https://forms.gle/EHKmTqnr3hqCrRZz6

Also send an email with the subject Quant Wing 2020 and your solution attached to the mail to wsc.bitsgoa@gmail.com

(If you are not fluent with GitHub, just send an email)

The deadline for submitting the assignment is August 18, 2020. (A 1 day buffer period will be provided if requested)

For any queries/questions/rants/feedback,
Contact:
Aditya Aryan
Quant Head
+919654423981