**Problem Set 1**

Due Friday, January 27th, before 11:59pm

*Instructions*: This is a group assignment. The size of your group must be less than or equal to 3 students. The memberships of groups may change for different homework assignments. Some assignments will be individual assignments.

*I suggest that you submit your computations in the form of an Excel file via Canvas. Because you can enter text into an Excel file, add labels to the file, format it for readability, etc., I think it makes sense put your entire solution into the Excel file, and submit just a single Excel file. I also add the following suggestions:*

*(a) Only submit one assignment per group but make it very clear who the group members are.*

*(b) The file name should be: PSn.FAMILYNAME1Initial1\_FAMILYNAME2Initial2….xls,*

*for example my solution to Problem set 1 would have the file name PS1.WIDDICKSM.xls.*

*(c) Please make sure that your Excel file is well-organized and clear, with appropriate text, explanations, and formatting. If I cannot figure out what you did, then what you did is wrong.*

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**Task (15 points)**

1. (12 points) Estimate the value of the Buffered PLUS on their date of issuance, based on the Value of the S&P 500 Index (SPX Index) due August 21, 2024 described in detail in the pricing supplement at:

<https://www.sec.gov/Archives/edgar/data/1665650/000121390022081774/s147117_424b2.htm>

1. (1 point) Make brief notes about any assumptions you have made and any concerns about your data you are using for your valuation. E.g. how confident are you that your parameters are exactly correct?
2. (2 points) If the value of the DJIA on 8/19/2024 is and on 8/21/2024 is 27919.47, calculate the realized (annualized) return for an investor who agreed to purchase these notes for $1000 on December 19, 2022. With hindsight, was it a good investment?

Notes

These notes were marketed and priced on December 19, 2022, on which date the SPX closed at 3,817.66[[1]](#footnote-2) but payment is made on December 27, 2022. The notes mature on August 21, 2024; however, the maturity date payment is based on the index closing value on August 19, 2024, the valuation date.

Also, please recognize that the payment is based on the reported index value, which **does not include** the reinvestment of any dividends paid by the portfolio underlying the index. That is, you must be careful to include a dividend yield in your calculation of the option price.

Necessary data (option implied volatilities, dividend yields and risk-free rates) can be obtained from Bloomberg – I have posted a file on where to get Bloomberg data from on Canvas. I can also answer questions via email.

**If you do not yet have access to Canvas, please send me your NetID and I can manually add you.**

*Hints:* **You should be able to value this product by only considering European options, which you can value using the Black-Scholes formula. Convert the returns into values of the SPX and then determine the option positions required to recreate the payoff of the products as I showed you in Lecture 1.**

**To value the options you will need the implied volatilities of the contracts. These are available only for certain maturities and strike prices and so you may need to interpolate to find an appropriate one for your options. Implied volatility typically varies over strike and maturity so you will need to match both.**

**Additionally, you will also need the dividend yields, and continuously compounded risk-free rates for different periods, you may also need to interpolate these for different maturities.**

**Good luck!**

Additional Information:

If you are curious about other issues of structured products, the pricing supplements are available from the SEC’s EDGAR database. Go to [https://www.sec.gov/edgar/search/#](https://www.sec.gov/edgar/search/) and type in a phrase to search for, this may be the name of a product, for example “Dual Directional Trigger security”, or an issuer, for example “Morgan Stanley”, or even a feature of the product, say “Autocallable”. To improve your search ensure to check for “Filing Type,” enter 424B2, because the pricing supplements that describe the structured products are “Form 424B2.”[[2]](#footnote-3)

Later on in the class we will consider other structured products – for example, you may be interested in this ‘fun’ product:

<https://www.sec.gov/Archives/edgar/data/0001666268/000183988221004580/ms1139_424b2-03053.htm>

1. Note that Bloomberg may give you a different closing price. You should use the one given in the prospectus in your answer. [↑](#footnote-ref-2)
2. For some other issuers they might be Form 424B3 or Form 424B5. [↑](#footnote-ref-3)