



## Stable Quant Researcher / Data Scientist Internship Online Screen Interview Questions

**Note:**

- You have **24 hours** to finish the below questions.
- Please **upload** your solution to the [FORM](#) provided in the email.
- Please **rename** your file to '**[First Name]\_[Last Name]\_stable.[EXT]**' (e.g. 'peter\_young\_stable.py', 'peter\_young\_stable.pptx', 'peter\_young\_stable.pdf').
- If you have any questions please reach out to [peter@stableprice.com](mailto:peter@stableprice.com)

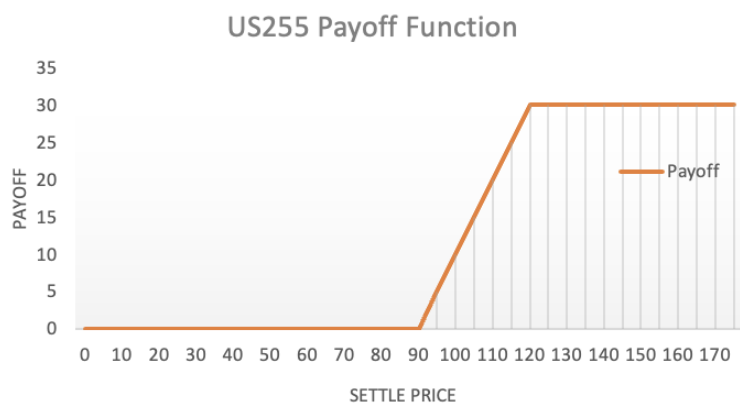
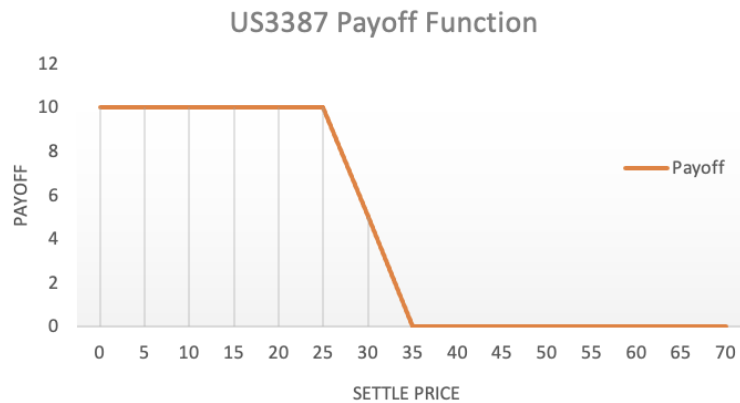
1. Index Price Forecast (please finish below task using python and send back the script/package)

For the two indices—‘US3387’ and ‘US255’ in the [Question DataSet.xlsx](#), they are two commodity product indices and have their monthly average spot prices recorded down, please **select 1** of the 2 indices to perform the following question:

- a. Import data into python development environment as a Data Frame variable called *data\_df\_raw*
- b. Convert the date column into datetime format and set them as the DataFrame index. Perform any necessary data cleaning/preprocessing. Write comments and/or any assumptions (if used) at the front of each preprocessing step taken.
- c. Predict the price for the next 18 steps (months) after the last available value. You can use any algorithm you want, and even other reference datasets not provided here. However, please try to contain everything in one file/package
- d. Prepare a 1-2 page Google Slides/ppt for your discoveries. Please show us a summary of your code, your forecast, why you think you have made a good (or bad) forecast, what else can be done, and any other information you want to share with us (including your guess of what price is this).

2. Derivatives Pricing (please continue task using python and send back in the same script/package)

- a. Replicate the below payoff structure using vanilla options **for the index you selected above for Q1** (see below payoff functions for US3387 and US255 separately)



- b. **For the index you selected,** we are issuing a derivatives contract fixing Nov 2022 with the corresponding payoff structure in 2.a. The strike levels are as in the plot—25 and 35 for US3387 / 90 and 120 for US255, and the contract expires in 12m. Could you please find a reasonable premium for the derivatives contract? Please write down all your assumptions and code out the function to calculate the premium with the result output
- c. Please backtest your pricing model (code)
- d. List the shortcomings or future improvement of your model
- e. Comment on your premium result for the option strategy, and suggest to the company decision makers, **that if we are the premium collector** (we charge the premiums to clients and take the payoff risk you see in 2.a), will that be a good opportunity for us and if not, what structure modifications you would suggest for our company to be better off.

3. (**bonus question**) Index Pattern Discovery and Modeling (*only finish if you still have time within 24 hour testing time limit, use the index you pick for below 3.b question*)
- a. Design models to detect index's seasonality and mean reverting pattern (code)
  - b. Suggest whether the index you pick display any of the above patterns and robustness (code)
  - c. Any other patterns you can think of which may help us get a better understanding of the underlying index for fair option derivatives pricing purpose?