Part I: Construct SPX and NDX Futures Fair Values

SPX and NDX futures expire on the third Friday of March, June, September, and December.

In this assignment, **you are to price all futures expiring before the end of 2026**.

1. **Data gathering**: In order to construct futures fair value for a specific expiry, we need dividend yield as well as spot risk free interest rate to the futures expiry
   a. *Yield expectation:*
      Use "indicated yield" of corresponding ETFs, SPY and QQQ, as proxy. You can find them on Bloomberg terminal using SPY <equity> DES <go>
   b. *Spot risk free interest rate*
   c. You can use zero coupon treasury strips as a proxy for this purpose. You can find them on Bloomberg terminal using FIT S/0-5 <go> for 0 to 5-year maturities. It's up to you to use either "Coupon Strips" or "Principal Strips" curves.

2. **Programming**:
   a. Write a python function to auto-generate the futures expiry dates
   b. Write a python function to look-up the spot risk free interest rate that has nearest maturity after a given date
   c. Write a python function to calculate the futures fair value, assuming interest rate curve is static

3. Output results:
   Calculate and output futures fair values given the spot index SPX=6600.35 and NDX=24223.69 in a table in the follow format

	DividendYld	SpotRate	SPX	NDX
Spot			6600.35	24223.69
Dec25				
Mar26				
Jun26				
Sep26				
Dec26				

Part II: Index Arbitrage

Use finance to retrieve historical intraday prices (I believe you can retrieve up to 15days of 1min bar data) for SPX and NDX futures (Yahoo tickers "ES=F" and "NQ=F"), as well as SPY and QQQ ETFs into the same dataframe.

1. Establish intraday futures basis stats
    a. At market open, you will establish $1mm index futures position and $1mm corresponding ETF position
    b. During the day, you are to track the futures basis = Futures - Cash
    c. Use first half of your daily data sample to establish distribution of the intraday futures basis
2. Trade the basis: for this exercise, you will use the following rules for trade entry and exit for each day of the second half data set
    a. Short basis trade:
        i. When futures basis > 1.5 std, short futures and long cash
        ii. When futures basis <1std, exit the position
    b. Long basis trade:
        i. When futures basis < -1.5 std, long futures and short cash
        ii. When futures basis > -1std, exit the position
    c. Exit the positions at the market close if you have open positions
    d. Tally up your daily trading P&L and summarize your trading stats in the following format:

Description	Stats
Number of days	
Average daily trades	
Average duration per trade	
Average daily P&L	
Maximum daily P&L	
Minimum daily P&L	
Stdev of daily P&L	