Final Project

Create a console application that value a set of derivatives trades, compute the PV and Greeks.

## Some key notes:

Market data:

1. Load curve data and create IR curve of USD-SORF and SGD-SORA:
   1. IR curve should have bucket tenor as Date class
   2. Rate we use data provided directly as zero coupon rate
   3. Interpolation function to get zero rate for any given date from curve
   4. Choose DF = - exp (Zr x T), Zr is zero rate from curve, and T is the date required to price derivative
2. Load vol data, create vol curve of tenor and vol value
   1. Vol data as lognormal vol
   2. Interpolation function which calculates vol using expiry date from vol curve

Trade:

1. Load trade from trade data file provide, create a portfolio of trades
2. Implement necessary PV function or Price function for each trade class

Model:

Swap and bond:

1. PV can be computed as discounting of future cash flows, using discount factor interpolated from IR curve
2. For swap, it can be also computed as (fixed leg rate – par rate) \* annuity. Par rate can be approximately interpolated from IR curve using swap end date, and annuity = fix leg notional \* sum of (coupon period \* discount factor at each coupon payment date of fixed leg).

European:

1. Price with black model
2. Price with any Binomial tree model, using time step = 50
3. Spot price should be taken from stock price file and IR rate and vol should be interpolated from given IR curve or Vol curve using expiry date

American:

1. Price with any Binomial tree model, using time step = 50
2. Spot price should be taken from stock price file and IR rate and vol should be interpolated from given IR curve or Vol curve using expiry date

Risk Engine:

1. Implement the risk engine to compute delta of IR and vega of vol
2. Central difference method to bump and IR curve (1bp) and vol Curve (1%) in parallel and compute the sensitivity as change of PV.

## Implementation requirements

1. No raw pointer should be used
2. Use at least one of design pattern

## Result requirement

1. Output pv, and Greek (total delta and total vega) by trade into a txt file.
2. A short write up to summarize below observation and some explanation
   1. Comparing tree model price of European vs Black and explain the difference
   2. Comparing the American and European trade pv and explain the difference