

## Application Dependencies

The program makes use of the latest boost package (Version 1.69.0) see link below:

<https://www.boost.org/users/download/>

**VIMP:** without the package installed and added to the IDE as an included library, the program will fail to run.

The program uses the following #includes:

```
#include <boost/lexical_cast.hpp>
#include <boost/bind.hpp>
#include <boost/function.hpp>
#include <boost/test/included/unit_test.hpp>
#include <boost/test/tools/assertion.hpp>
#include <boost/math/constants/constants.hpp>
#include <boost/math/distributions/normal.hpp>
```

## Unit Tests

The following items are checked to give comfort towards the validity of the results:

- The **Standard Normal CDF** is returning  $\frac{1}{2}$  when an input of zero is used.
- **Brent solver** I take a quadratic  $(x+1)*(2x-1)$  with roots  $(1/2, -1)$  clearly visible from the analytical solution and return one of the roots given an interval  $[0.0001, 2]$
- **Implied volatility** to verify I am returning the correct volatilities I price an option with volatility equal to 20% and using this option price I use the Brent solver to return the same volatility used at the beginning.

## Observations/Remarks

- Max Iteration from the Brent solver never seems to go above 40 so I have capped it to improve computing time.
- The implied volatility occurs as 'nan' sometimes as the Brent solver can no longer find a large enough volatility to match the option price given. This is because the normal CDF is converging and little changes in volatility is no longer causing changes in the option price. Below graph is from trade ID 39.

