Project 8 by
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Q1. Vasicek Model

```
/Users/akumar/anaconda/bin/python /Users/akumar/Python/com/ashwin/computationalmethodsinfinance/Project8/Q1.py
1.a) Pure Discount Bond = 975.439855      ****[2.505896 sec]
1.b) Coupon Bond = 1048.146454              ****[45.471726 sec]
1.c) European Call Zero Coupon Bond = 8.795093    ****[0.115418 sec]
1.d) European Call Coupon Bond = 82.130510     ****[18.123460 sec]
1.e) European Call Zero Coupon Bond (explicit) = 82.392077  ****[0.082331 sec]
```

We can see that 1.d) European Call on Coupon Paying bond tends towards semi-explicit solution. The explicit formula (completely explict – has fsolve for r*) is commented in the Python code submitted which can be verified to be close to semi-explicit. The 1.e) option value converges faster for MC simulated r* and hence can be substituted for completely explicit closed form solution.

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Q2. CIR Model

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/Users/akumar/anaconda/bin/python /Users/akumar/Python/com/ashwin/computationalmethodsinfinance/Project8/Q2.py
2.a) European Call Zero Coupon Bond = 0.391877    ****[11.533110 sec]
2.b) Implicit Differential Method European Call Zero Coupon Bond = 0.406202   ****[0.075657 sec]
2.c) European Call Zero Coupon Bond = 0.394058   ****[0.003834 sec]

Process finished with exit code 0
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The three methods give approximately the same result. MC Simulation results has higher variance. Increasing the nsim1*nsim2 gives lower variance for the result and shows convergence towards the Implicit form.
The Finite Difference Method (with given dr & dt) provides a stable solution which is close to the explicit form as well.

Q3. G2++ Model

```
/Users/akumar/anaconda/bin/python /Users/akumar/Python/com/ashwin/computationalmethodsinfinance/Project8/Q3.py
3.a) MC Simulation European Put Zero Coupon Bond = 1.881080    ****[7.464252 sec]
3.b) European Put Zero Coupon Bond = 1.860960   ****[0.000917 sec]

Process finished with exit code 0
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European Put Option MC Method gives 1.88 while the Closed Form Solution yields (explicit) Put Option Price = 1.86.
The number of simulations used is 500*200. Increasing the simulation might decrease the variance of the error but the mean tends towards 1.86