Problem 3

1. Using the native Matlab function the following constant intensity Poisson probabilities were computed for =0.02 and t = 5.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | n = 0 | n = 1 | n = 2 | n = 3 | n = 4 | n = 5 |
|  | 0.9048 | 0.0905 | 0.0045 | 1.5\*10^-4 | 3.78\*10^-6 | 7.54\*10^-8 |

1. Using a custom inhomogeneous intensity Poisson process probability distribution function as governed by the deterministic intensity function in the prompt, the following probabilities were computed

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | n = 0 | n = 1 | n = 2 | n = 3 | n = 4 | n = 5 |
|  | 0.7408 | 0.2222 | 0.0333 | 0.0033 | 2.5\*10^-4 | 1.5\*10^-5 |

1. The following plots are representative of CIR and Vasicek filtrations given the parameters in the prompt:
2. If we generalize the intensity function to a stochastic function rather than a deterministic function of time, out probability distribution function becomes depend on each filtration. For each realized filtration, we can calculate the conditional jump probabilities for a Cox process as . As a result, the generalized formula for the unconditional jump probabilities for a Poisson process of stochastic intensity would be .
3. Using the general formula, = 1.96\*10^-4 for the Vasicek and 1.96\*10^-4 for the CIR model.

Problem 4

b. The zero spreads calculated for T=1,…,10 with a recovery rate of R=0.4 and a risk free rate of r = 0.04.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | T=1 | T=2 | T=3 | T=4 | T=5 | T=6 | T=7 | T=8 | T=9 | T=10 |
| CIR | 0.0044 | 0.0039 | 0.0034 | 0.003 | 0.0026 | 0.0021 | 0.0017 | 0.0013 | 0.0009 | 0.0004 |
| VAS | 0.0044 | 0.0039 | 0.0035 | 0.003 | 0.0026 | 0.0022 | 0.0017 | 0.0013 | 0.0009 | 0.0005 |

c. As T goes to zero, the spread should converge to , or in this case 0.02\*0.4 = 0.008.