FE-680 – Assignment 4

Problem 1

Verify that if the CDS spread for the example in Tables (1 to 4) is 100 basis points, then the probability of default each year (conditional on no earlier default) must be 1.61%. How does the probability of default change when the recovery rate is 20% instead of 40%? Verify that your answer is consistent with the implied probability of default being approximately proportional to $1/(1-R)$ where R is the recovery rate.

Table 1. Unconditional default probabilities and survival probabilities

Time (years)	*Default probability*	*Survival probability*
1	0.0200	0.9800
2	0.0196	0.9604
3	0.0192	0.9412
4	0.0188	0.9224
5	0.0184	0.9039

Table 2. Calculation of the present value of expected payments. Payment = s per annum

Time (years)	*Probability of survival*	*Expected payment*	*Discount factor*	*PV of expected payment*
1	0.9800	$0.9800s$	0.9512	$0.9322s$
2	0.9604	$0.9604s$	0.9048	$0.8690s$
3	0.9412	$0.9412s$	0.8607	$0.8101s$
4	0.9224	$0.9224s$	0.8187	$0.7552s$
5	0.9039	$0.9039s$	0.7788	$0.7040s$
Total				$4.0704s$

Table 3. Calculation of the present value of expected payoff. Notional principal = $1.

Time (years)	*Probability of default*	*Recovery rate*	*Expected payoff ($)*	*Discount factor*	*PV of expected payoff ($)*
0.5	0.0200	0.4	0.0120	0.9753	0.0117
1.5	0.0196	0.4	0.0118	0.9277	0.0109
2.5	0.0192	0.4	0.0115	0.8825	0.0102
3.5	0.0188	0.4	0.0113	0.8395	0.0095
4.5	0.0184	0.4	0.0111	0.7985	0.0088
Total					0.0511

Table 4. Calculation of the present value of accrual payment.

Time (years)	*Probability of default*	*Expected accrual payment*	*Discount factor*	*PV of expected accrual payment*
0.5	0.0200	$0.0100s$	0.9753	$0.0097s$
1.5	0.0196	$0.0098s$	0.9277	$0.0091s$
2.5	0.0192	$0.0096s$	0.8825	$0.0085s$
3.5	0.0188	$0.0094s$	0.8395	$0.0079s$
4.5	0.0184	$0.0092s$	0.7985	$0.0074s$
Total				$0.0426s$

Problem 2

Suppose that the risk-free zero curve is flat at 4% per annum with continuous compounding and that defaults can occur at times 0.25 years, 0.75 years, 1.25 years, and 1.75 years in a two-year plain vanilla credit default swap with semiannual payments. Suppose that the recovery rate is 20% and the unconditional probabilities of default (as seen at time zero) are 1% at times 0.25 years and 0.75 years, and 1.5% at times 1.25 years and 1.75 years. What is the credit default swap spread? What would the credit default spread be if the instrument were a binary credit default swap?

Problem 3

Consider the following CDSs for Goldman Sachs:

Tenor	CD1016 Mid Spr GS Sr CDS	Spread (bps)
6M	GS CDS USD SR 6M D14 Curncy	30.2
1Y	GS CDS USD SR 1Y D14 Curncy	38.9
2Y	GS CDS USD SR 2Y D14 Curncy	47.1
3Y	GS CDS USD SR 3Y D14 Curncy	58.8
4Y	GS CDS USD SR 4Y D14 Curncy	72.8
5Y	GS CDS USD SR 5Y D14 Curncy	83.9
7Y	GS CDS USD SR 7Y D14 Curncy	109.8
10Y	GS CDS USD SR 10Y D14 Curncy	127.7

<u>Reference Entity Information</u>
Name: Goldman Sachs Group
Sector: Financials
Industry: Financial Industry

Credit Default Swap Contracts Information
Country: US
Coupon Frequency: Quarterly
Debt Type: Senior
Day Count: ACT/360
Currency: USD
Recovery: 0.40

Consider the following Interest Rate Yields:

Tenor	Yield
1M	0.995
2M	1.0372
3M	1.1696
6M	1.4304
1Y	1.7765
2Y	1.5635
3Y	1.7165
4Y	1.839
5Y	1.9365
6Y	2.024
7Y	2.097
8Y	2.161
9Y	2.2205
10Y	2.267
12Y	2.352
15Y	2.431
20Y	2.504
25Y	2.529
30Y	2.533

Please estimate the hazard rate curve from the CDS spreads of GS. For the valuation model assume the JPMorgan model (defaults can occur midway during each payment period, but the accrual is made at the end of the periods).