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1 Question 1. Suppose three firms have PD's and PDJ's as follows:

PD_1	PD_2	PD_3	$PDJ_{1,2}$	$PDJ_{1,3}$	$PDJ_{2,3}$
0.1	0.2	0.3	0.06	0.06	0.06

Find the three values of correlation, $\rho_{1,2}$, $\rho_{1,3}$, and $\rho_{2,3}$ and find the three values of default correlation, $Corr[D_1, D_2]$, $Corr[D_1, D_3]$, and $Corr[D_2, D_3]$

$$Dcorr[1,2] = 0.33$$

$$Dcorr[1,3] = 0.22$$

$$Dcorr[2,3] = 0.0$$

$$Rho[1,2] = 0.6$$

$$Rho[1,3] = 0.43$$

$$Rho[2,3] = 0.0$$

2 Question 2 Suppose that each of three firms have $PD = 0.10$ and that the correlations are

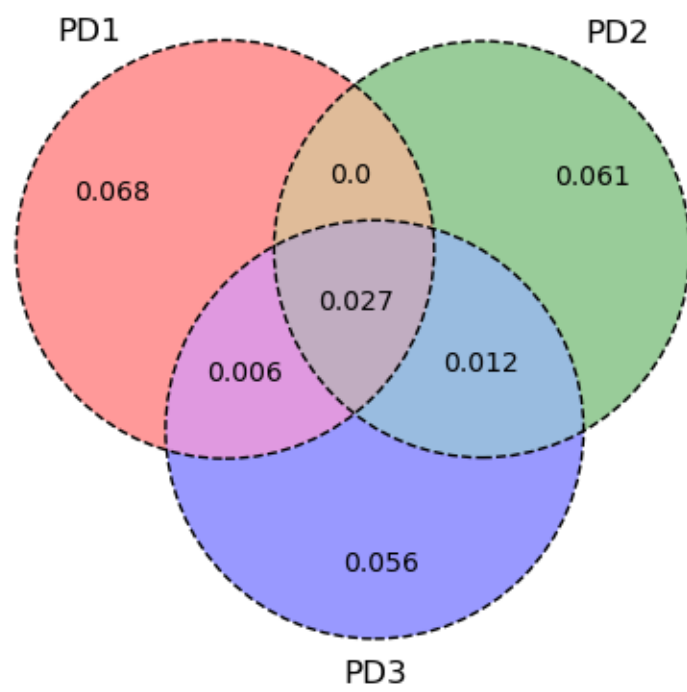
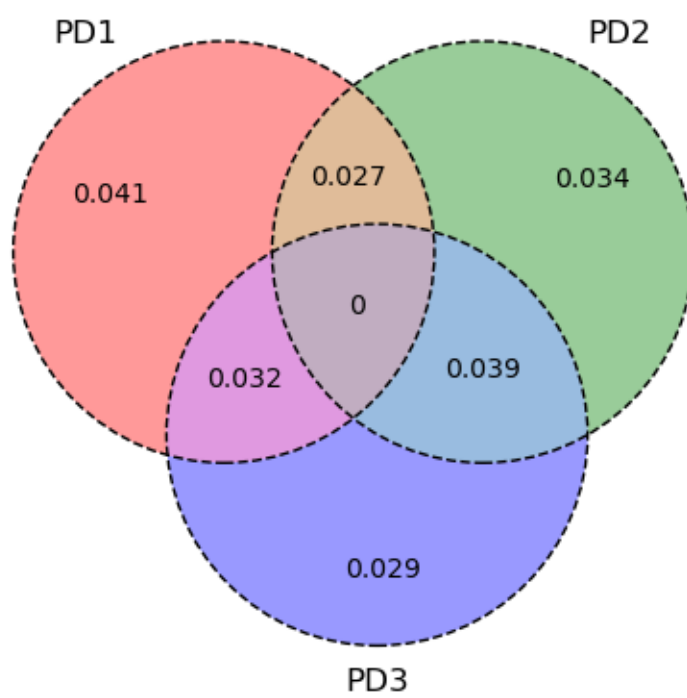
1	0.4	0.5
0.4	1	0.6
0.5	0.6	1

State the three values of PDJ. State the range of possible values for the probability that all three of the firms default. State the probability that all three default under the Gauss copula.

$$PDJ_{12} = 0.027$$

$$PDJ_{13} = 0.032$$

$$PDJ_{23} = 0.039$$



The range of PDJ123 is from 0.0 to 0.027

PDJ123 = 0.016

3 Question 3. Suppose a firm rated A has correlation 0.4 with a firm rated B. In the following period, Firm A remains rated A with prob = 0.5, and so forth:

Transition Probabilities

Initial Rating	Final Rating = A	Final Rating = B	Final Rating = D
A	0.5	0.4	0.1
B	0.3	0.5	0.2

In your answer file, create a three-by-three grid. Fill in the cells with probabilities of final rating that sum to 1.00. Two digits of accuracy is sufficient, e.g., 0.66. Assume that transitions obey a Gauss copula.

Pdd = 0.044

Pbd = 0.101

Pdb = 0.047

Pbb = 0.215

Pad = 0.055

Pda = 0.009

Pab = 0.238

Pba = 0.084

Paa = 0.207

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+---+-----+-----+-----+
|   |   D   |   B   |   A   |
+---+-----+-----+-----+
| A | 0.009 | 0.084 | 0.207 |
| B | 0.047 | 0.215 | 0.238 |
| D | 0.044 | 0.101 | 0.055 |
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4 Question 4. Suppose that four firms have PDs equal to 1%, 2%, 3%, and 4% and the probability that any given pair defaults equals 0.1%. What is the matrix of correlations? Explain whether the connection between the defaults of the four firms is consistent or not consistent with a Gauss copula.

The correlation matrix is:

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|   |   1   |   2   |   3   |   4   |

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+---+-----+-----+-----+-----+
| 1 |    1    | 0.311 | 0.237 | 0.183 |
| 2 | 0.311 |    1   | 0.101 | 0.044 |
| 3 | 0.237 | 0.101 |    1   | -0.036 |
| 4 | 0.183 | 0.044 | -0.036 |    1    |
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Is rho positive definite? True

Is rho symmetric? True

The eigenvalues of rho are: [1.48024501 0.60944612 1.03579131 0.87451755]