



Subject: SRM 4

Chapter: Unit 1 & 2

Category: Assignment

1. An investor purchases three 5-year bonds from different companies within the same industry sector. The probability that an individual bond defaults within the first year is 10%.
 - i) Using a Gumbel copula with parameter $\alpha = 2$, calculate the probability that all three bonds default within the first year. (4)
 - ii) Discuss the suitability of the Gumbel copula in this situation. (4)

2.
 - i) List the three parameters of the Generalized Extreme Value distribution. (2)
 - ii) What do these parameters determine? (2)
 - iii) What are the analogous parameters for these in a standard distribution? (2)

3.
 - i) List the four ways of measuring the tail weight of a particular distribution. (1)
 - ii) Compare the two Pareto distributions with parameters $\alpha = 0.2$ and $\alpha = 0.3$ (with equal λ) respectively using 'Limiting density Ratio' method. (2)

4. A medium size life insurance company is selling Joint Life Term Insurance products to married couples. The product waives the premium on death of one life and pays the Sum Assured on death of second life. The probability of survival for thirty years for a 50 years old male life is 0.60 and for a 50 year old female life is 0.65. The company sold this policy to couple both aged 50 for a thirty year term. Calculate the probability of paying a death benefit in the above policy using
 - i) The Gumbel Copula with $\alpha = 3.5$ (2)
 - ii) The Clayton Copula with $\alpha = 3.5$ (1)
 - iii) The Frank copula with $\alpha = 3.5$ (1)
 - iv) Comment on the suitability of the above copulas by comparing the results to those when independent deaths are assumed.

5. The lifetime of a new mobile phone variety follows an exponential distribution with $\lambda = 0.125$. An actuarial student has purchased one such phone in online exactly two years from the date of manufacturing.

- i) Calculate the Mean Residual Life of the phone the student has purchased two years ago by deriving the formula.
(3)
- ii) Using the result of (i), comment on the suitability of Exponential Distribution for modelling Mean Residual Life.
(2)

6. i) For Gumbel copula, determine whether the generator function:

$$\psi(t) = (-\ln t)^\alpha$$

is a strict generator function for $\alpha \geq 1$, and determine the inverse generator function for Gumbel copula.

- ii) Derive the coefficient of lower tail dependence for the Gumbel copula for $\alpha \geq 1$.