

# On the reliability of complex systems with three dependent components per element

Mostafa Razmkhah

Department of Statistics, Ferdowsi University of Mashhad,

26 April 2017

## Abstract

Consider a system consisting of  $n$  elements and assume that each element has three components  $(A_i, B_i, C_i)$  with the corresponding lifetimes  $(X_i, Y_i, Z_i)$ , for  $i = 1, 2, \dots, n$ . We assume that the components of the  $i$ th element are dependent, i.e.,  $X_i, Y_i$ , and  $Z_i$  are dependent random variables with joint cdf  $F(x, y, z)$ , but the elements work independently with each other. More precisely, the random vectors  $(X_1, Y_1, Z_1), (X_2, Y_2, Z_2), \dots, (X_n, Y_n, Z_n)$  are assumed to be independent. A system is called the  $(r_1, r_2, r_3)$ -out-of- $n$  system if it functions iff at least  $r_1$  of the components  $A_1, A_2, \dots, A_n$  function, at least  $r_2$  of the second components  $B_1, B_2, \dots, B_n$  and at least  $r_3$  of the third components  $C_1, C_2, \dots, C_n$  function. The reliability and mean residual life of such systems with intact components at time  $t$  are investigated using a trivariate binomial model. Considering a Farlie-Gumbel-Morgenstern family, some graphical representations are given.