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library(copula)
library(fCopulae)
library(Ecdat)
library(fGarch)
library(MASS)

##############################
# Simulating Copulas
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cop_t_dim3 = tCopula(c(-.6,.75,0), dim = 3, dispstr = "un", df = 1)
set.seed(5640)
rand_t_cop = rCopula(500,cop_t_dim3)


1.
# Three dimensional Student t-copula
2.
# Sample size is 500.
3.
pairs(rand_t_cop)
cor(rand_t_cop)
4.
# No, Var 2 and Var 3 do not seem independent.
5.
# We see both positive tail dependence and negative tail dependence
6.
#Correlation causes the data to be concentrated on a diagonal
7.
#The correlations are different because of more than chance.

cop_normal_dim3 = normalCopula(c(-.6,.75,0), dim = 3, dispstr = "un")
mvdc_normal <- mvdc(cop_normal_dim3, c("exp", "exp","exp"), list(list(rate=2), list(rate = 3), list(rate=4)) )
set.seed(5640)
rand_mvdc = rMvdc(1000,mvdc_normal)
pairs(rand_mvdc)
par(mfrow=c(2,2))
plot(density(rand_mvdc[,1]))
plot(density(rand_mvdc[,2]))
plot(density(rand_mvdc[,3]))

7.
#All three distributions are exponential with rates 2, 3 and 4 for variables 1, 2 and 3, respectively.
8.
#Second and third variables are independent because the corresponding correlation in the copula is 0 and the
copula is Gaussian.
rand_t_cop = rCopula(500,cop_normal_dim3)
pairs(rand_t_cop)
```