**FINN 6216 Homework Assignment #2.3**

**Same rules as always.**

1. Consider a joint Bernoulli random vector with Write out the marginal distribution functions and the joint distribution Since this distribution is not continuous, there may be more than one copula such that Please give two different such copulas.
2. Using the method we discussed in class, create a Gaussian copula for the absolute shifts from Homework 1.1, and use that to create a 2-dimensional distribution which has the empirical distributions as the marginals. Starting with being the empirical correlation, compute the correlation you actually get from the distribution you create. Can you adjust the input so that the final correlation is the same as the original empirical correlation?
3. Go back once again to the data for AAPL and SPY we used in HW 1.1. I would like you to fit each 1-dimensional set of absolute shifts using a separate t distribution. Use a 1-dimensional log likelihood function and a solver to arrive at the best degrees of freedom parameter for each stock (they will be different). Now use a Gauss copula, based on a joint standard normal distribution with correlation equal to the empirical correlation, to tie the two t distributions together into a joint distribution. Now do a Monte Carlo of that distribution (5000 scenarios), and compute 99% VaR and 97% Expected Shortfall based on full revaluation on the position described in HW1.1, Problem 1. How well does this fit the data compared to the t distribution you used in HW1.3, problems 1 and 2? Compute a log likelihood estimator based on the joint density to find out.

**This homework assignment is due Thursday, February 23.**