QUIZ 6 - Amanjit Gill - Dec 6, 2022

Calculations for Question 1

$K=6,\ p=4$

probabilities :	$K-1$	5
means:	Kp	24
λ (size) :	K	6
A (shape) :	$K(p-1)$	18
P (orientation) :	$\binom{p}{2}$	6
		59

QUIZ 6

Amanjit Gill

December 6, 2022

```
library(mclust)
```

```
## Package 'mclust' version 6.0.0
## Type 'citation("mclust")' for citing this R package in publications.
```

```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(GGally)
```

```
## Loading required package: ggplot2
```

```
## Registered S3 method overwritten by 'GGally':
##   method from
##   +.gg   ggplot2
```

```
library(copula)

# QUESTION 6 - PART A

X <- read.csv("X.csv")

ans_a_fit <- Mclust(X)

ans_a_K <- 6

# QUESTION 6 - PART B

ans_b_fit <- Mclust(X, G=2)

ans_b_o <- TRUE

# QUESTION 7 - PART A

X <- matrix(c(1.35, -0.53, 0.73, 7.72, 1.86, 0.19, 0.54, 2.07, 0.92, 1.76,
              1.18, -0.65, 1.9, 0.17, 1.58, 0.23, 0.5, 0.96, 1.97, 1.79,
```

```
              2.06, 1.17, 0.93, -3.41, 0.96, -1.02, 0.84, 1, 0.63, -1.42,
              1.96, -2.15, 1.23, 5.11, 0.15, 2.18, 1.2, -1.8, 0.56, 0.04),
            20, 2, byrow=TRUE)

XU <- pobs(X)

e_fit <- fitCopula(normalCopula(dim=2), XU, method="irho")

ans_a_r <- -0.1965

# QUESTION 7 - PART B

normGNc <- mvdc(normalCopula(dim=2), margins=c("gamma","norm"),
                paramMargins = list(list(shape=1, rate=1),
                                    list(mean=0, sd=1)))

gn_fit <- fitMvdc(as.matrix(X), normGNc, start = c(1,1, 0,1, 0))

summary(gn_fit)
```

```
## Call: fitMvdc(data = as.matrix(X), mvdc = normGNc, start = c(1, 1,
##     0, 1, 0))
## Maximum Likelihood estimation based on 20 2-dimensional observations.
## Copula:  normalCopula
## Margin 1 :
##          Estimate Std. Error
## m1.shape    3.358      1.014
## m1.rate     2.914      0.949
## Margin 2 :
##         Estimate Std. Error
## m2.mean   0.6731      0.545
## m2.sd     2.4363      0.385
## Normal copula, dim. d = 2
##       Estimate Std. Error
## rho.1  -0.2033      0.214
## The maximized loglikelihood is -62.73
## Optimization converged
## Number of loglikelihood evaluations:
## function gradient
##       59       21
```

```
ans_b_r <- -0.2033

ans_b_mean <- 0.6731
ans_b_sd <- 2.4363

ans_b_shape <- 3.358
ans_b_rate <- 2.914
```