1. PCA was performed on a dataset that contains the measurements of 154 metabolites profiled at several time points after treatment (more specifically at times 0 h, 4, 12, 24, 48 and 96 h after treatment). For each time point several replicates were measured) : The total datamatrix mDC (dim 154 X 52) contains 52 columns (corresponding to the timepoints and their replicates) and 154 metabolites (rows). The lines below illustrate how the data look like:

X12h.1 refers to e.g. timepoint 12 first replicate

mDC[1,]

X0h X0h.1 X0h.2 X0h.3 X0h.4 X0h.5 X0h.6 X1h X1h.1 X1h.2 X1h.3 X1h.4 X1h.5 X1h.6 X1h.7 X4h X4h.1 X4h.2 X4h.3 X4h.4

 0.0015 0.0252 0.0159 0.0116 -0.0431 -0.0053 -0.0058 0.0127 0.0309 0.0092 0.0430 -0.0457 -0.0108 -0.0126 -0.0831 0.0192 0.0156 -0.0015 -0.0500 -0.0481

 X4h.5 X12h X12h.1 X12h.2 X12h.3 X12h.4 X12h.5 X12h.6 X12h.7 X24h X24h.1 X24h.2 X24h.3 X24h.4 X24h.5 X24h.6 X48h X48h.1 X48h.2 X48h.3

 0.0127 0.1563 0.1174 0.1112 0.1411 0.0287 0.0597 0.0641 0.0839 0.1388 0.1160 0.1008 0.0276 0.0917 0.0629 0.0574 0.2348 0.2672 0.2599 0.2314

 X48h.4 X48h.5 X48h.6 X48h.7 X96h X96h.1 X96h.2 X96h.3 X96h.4 X96h.5 X96h.6 X96h.7

 0.1901 0.2015 0.2209 0.1881 0.3410 0.3206 0.2923 0.3276 0.2742 0.2560 0.2424 0.2655

PCA was applied to this dataset as follows

PCAres<-prcomp(t(mDC), scale = TRUE, center=TRUE)

And the results were plotted as follows

plot(PCAres$rotation[,1],PCAres$rotation[,2], pch=20, col="gray40")

abline(v=0, col="gray")

abline(h=0, col="gray")

text(PCAres$rotation[,1],PCAres$rotation[,2], labels=sub("X(.+h)(\\..)?","\\1",rownames(PCAres$rotation)),cex=1, col="red", adj = c(0,0))



plot(predict(PCAres)[,1],predict(PCAres)[,2])

abline(v=0, col="gray")

abline(h=0, col="gray")

text(predict(PCAres)[,1],predict(PCAres)[,2], labels=sub("X(.+h)(\\..)?","\\1",rownames(t(mDC))),cex=1, adj = c(0,0))



Explain what is plotted in the figure above, give a complete answer by first explaining what PCA does and then illustrating your explanation with the example shown in the figure, your explanation should define the variables and the observations. Interpret the results.

2) Golub is a gene-patient dataset. The dataset contains 50 patients and 3051 genes. Explain the code below line per line. Explain why you need to perform the different steps, what they are doing and how you have to interpret the outcome (what do you expect as outcome).

dim(golub)

# [1] 3051 38

golub\_m = golub – rowMeans(golub)

SD = apply(golub, 1, sd, na.rm=TRUE)

golub\_r = golub\_m/SD

d.euclidian\_r <- dist(golub\_r, method="euclidian")

m <- as.matrix(dist(golub\_r))

dim(m)

#(3051,3051)

kmeangolub10= kmeans(d.euclidian\_r,10)

table(kmeangolub10$cluster)

#1 2 3 4 5 6 7 8 9 10

#315 319 262 370 280 266 264 352 332 291