MATH1309 – Practice Problems 3

By hand

1. Let **X** be $N_3(\boldsymbol{\mu}, \boldsymbol{\Sigma})$ with $\boldsymbol{\mu}' = [-3,1,4]$ and $\boldsymbol{\Sigma} = \begin{bmatrix} 1 & -2 & 0 \\ -2 & 5 & 0 \\ 0 & 0 & 2 \end{bmatrix}$ Which of the following random variables are independent? Explain.
    a. X_1 and X_2
    b. X_2 and X_3
    c. (X_1,X_2) and X_3
    d. $\frac{X_1+X_2}{2}$ and X_3
    e. X_2 and $X_2 - \frac{5}{2}X_1 - X_3$

Using Software

PROC IML

Call an existing dataset in PROC IML

Adding in the line Use allows you to refer to a dataset that already exists in SAS. This may be a data set that you have read in from a file using a DATA step first.

You can also specify the variables that you want to read in by listing them, or you can read all of the variables by using the_all_ argument. (Note that the first all is for all of the observations).

```
proc iml; /* Activate IML(Interactive Matrix Language) */
use example3; /*refer to an existing dataset in SAS*/
read all var _all_ into A;/* read all observations of all
variables*/
```

Summarise sample data

Once you have a sample data set you can calculate the unbiased covariance matrix, the correlation matrix and the mean vector.

Covariance	`cov(A)`
Correlation	`corr(A)`
Mean	`mean(A)`

Test for Normality

Chi-square plot

Once you have a sample data set in PROC IML you can calculate the Chi-square probabilities and the Mahalanobis distances to construct a Chi-square plot.

1) Read in the Data file Example_4.DAT as on SAS Studio and Canvas
   a) Calculate the covariance matrix
   b) Calculate the mean vector
   c) Find the Mahalanobis distances and then extract the diagonal with `D=vecdiag(A)`
   d) Rank the distances using `ranks=rank(D)`
   e) Find the chi-square values for your ranks and output this using:

```
f0=(ranks-0.5)/n; /* Compute the relative frequency
*/chiq=cinv(f0,p); /* Quantile using Chi-square distribution with p
degrees of freedom */
chiplot=mahala||chiq;
create chiplot from chiplot[colname={'MAHDIST' 'CHISQ'}]; /*create a
dataset to plot*/
append from chiplot;
```

2) Create a scatter plot of your output file chiplot using proc sgplot and a single scatter plot.