**ASSESSMENT 2**

**Simulation Exercises in R**

**Introduction**

Using some of the information provided in the previous R exercises and the R readings and References (as well as Google and any R textbooks) you are required to undertake and complete the following two tasks:

**TASK 1**

1. **Simulate** a matrix of data using R (in effect an image of numbers where each cell in the matrix has a number on the numerical scale of 0-255 (8 bit data))
2. Map the simulated data using mapping tools
3. Classify the image into 8-10 classes
4. Document the algorithm/method used
5. Include illustrations to accompany your methodology
6. Write up as a short report that provides as much detail as possible, is spell checked and formatted, and includes any references used

**Hints**

* Use a Matrix of data
* Use 0-255 scale

You may need to use some or all of the following:

* matrix ()
* myImagePlot()
* image ()
* library(gplots)
* library(lattice)
* Packages: Rcolorbrewer, ggplot
* And any others you choose to use. Note that there are a number of ways to undertake this exercise, and you should ALL seek to complete the exercise YOUR WAY rather than assuming that there is only one way to do it.
* **NOTE: Remember to check out the packages and their functions by searching online.**

**TASK 2**

1. Download a small DTM/DEM of Findhorn Bay area from EDINA Digimap ([www.edina.ac.uk](http://www.edina.ac.uk)) – the map tiles you download must be in **ASCII** format (.asc). **NOTE**: you will need to register for EDINA – it may take 24hrs.
2. You will need to register to use the EDINA Digimap service (up to 24 hours)
3. Read the .asc file into R
4. Plot the DTM/DEM
5. Reclassify the DTM so that you can **simulate** changes to sea level – and *in effect* the inundation of water onto the land
6. Add a title and box as well as a North arrow so that you have a map output
7. Document the algorithm/method used
8. Write up (as before)
9. As an additional small task – I have placed a DTM derived from aerial imagery captured by a DJI Phantom 3 UAV (<https://www.dji.com/phantom-3-standard>) and processed into a 3D model using Pix4D softcopy photogrammetry software: (<https://pix4d.com/>).

See if you can display the 3D model (DTM) using R. (Data Files in COASTAL FOLDER)

You may find some or all of the following useful when undertaking this task:

* Wordpad (to examine the ASCII data
* title ()
* box ()
* getwd ()
* setwd ()
* list.files ()
* library ()
* reclassify ()
* names ()
* summary ()
* sp ()
* str ()
* help ()
* require ()
* image ()
* contour ()
* axis ()
* as.matrix
* set.seed()
* rand()
* rnorm()
* Packages: raster, rgdal, spplot, graphics, sp, Rcolorbrewer

**Submission and Submission Date**

You write up your Tasks in the form of a **Report** which should include:

* **A title, abstract, and Introduction/context to the task.**
* **Your Annotated Code for Task 1 and Task 2.**
* **Task 2 in particular should include some context about the study area and the potential of the data/imagery etc. to the problem facing the study area.**
* **Summary and Conclusions**
* **References Used**
* **Appendices**

Weeks 12/13 of SHS – 17.00 – (Turnitin **ONLY**) – a Date will be provided.

**SOME NOTES & HINTS**

Initially the best way to start on this is to try and draft out a plan of the steps you might need to generate the results for each task i.e. the stages that you might need to follow to go from the start to finish. Then you can *flesh out* the details and look into the code you might need to complete the tasks.

Looking over some of the previous exercises in R may also help – as some of the functions/ideas etc. may help to provide some ideas/clues. There are readings and reference documents to assist you e.g. documents for some of the packages that may have commands/code that may be of use to you when generating the plots/images/maps.

In **TASK 1** – the idea is to use a simple function to generate an image – in effect a band of imagery from a UAV, aircraft, or satellite. You could of course generate a whole series of different spectral bands to simulate an image of an area e.g. equivalent to an UAV/aerial photograph (e.g. 3 bands of Red, Green and Blue imagery) or a Landsat TM image (7 spectral bands).

To do this – you need to think about the format of a digital UAV/aerial photograph or satellite image e.g. what does it comprise? How would you generate numbers on the scale of 0-255? (0-255 is 8 bit data – which is the usual format for a band of satellite imagery – which means numbers (radiance values) of between 0 and 255 (256 levels).

Once you have a rough idea of how you might achieve this – you can then do a little bit of searching on the Web to see if you can utilise any existing R scripts or parts of R scripts to yield the result.

In **TASK 2** – this is a little more complicated – as you first have to read in the data from a source to R, and then think about how you (a) might display the data as an image (visualise the data), and (b) consider how you might simulate sea level rise using R.

Both tasks can be achieved in numerous different ways using the packages and libraries provided with R.

So there are many possible solutions to these TASKS!

**SOME MORE HINTS**

**See PowerPoint File for outline of Simulation Exercise**