

1 MAT013 Coursework

Deadline: 8/5/2013 at 0900

1.1 Instructions

The outputs of this coursework will be:

- A written report describing your code (SAS and R) to be handed in to Joanna Emery.
- An appendix containing a commented version of your code (SAS and R) to be handed in to Joanna Emery.
- A file containing the required SAS code. Name this file SAS-lastname-STUDENTNUMBER (eg. Knight-123456) and email it to Joanna Emery with MAT013 as the subject. Note that all operations needed to complete the coursework should be included in the SAS code.
- A file containing the required R code. Name this file R-lastname-STUDENTNUMBER (eg. Knight-123456) and email it to Joanna Emery with MAT013 as the subject. Note that all operations needed to complete the coursework should be included in the R code.

1.2 Coursework

1. Using both SAS and R (in other words attempt this question using SAS and then using R):

Write code (in SAS: a macro, in R: a function) that will reproduce a mathematical procedure covered in MAT001 or MAT002. Clearly document this procedure in your report.

[20]

2. Using SAS:

The data files [Greedy.csv](#), [Random.csv](#), [Longest.csv](#) and [Shortest.csv](#) contain data relevant to the experimental play of 4 strategies for the game [Shut the Box](#) (you do not necessarily need to know of this game to complete this coursework).

The four strategies will be referred to as:

- Greedy
- Random
- Longest
- Shortest

The data file contains two variables for each strategy: **Score** and **Length**. The aim of the game is to have the lowest score (a minimum of 0).

- i. Obtain plots of the distribution of the **Score** variable for each strategy (represent these distributions on the same graph);
- ii. Obtain plots of the distribution of the **Length** variable for each strategy (represent these distributions on the same graph);
- iii. For each method are **Score** and **Length** related?
- iv. Do the strategies give different outcomes and if so which strategy seems to be the best?

[25]

3. Using R:

Write a function that will return the n th [Fibonacci number](#), $F(n)$.

Modify the function so that it returns the n th number of the sequence defined by:

$$\begin{aligned} K(0) &= a \\ K(1) &= b \\ K(n) &= \alpha K(n-1) + \beta K(n-2) \end{aligned}$$

Where a, b, α and β are input parameters.

Adapt your function so that it will write all numbers of the form $K(n)$ less than some number k to a csv file. The name of the csv file must not be an input parameter to the function but include the parameters a, b, α and β as well as the date on which the code was run. For example: `general_fib_for-a=2-b=3-alpha=10-beta=-2_1984-14-02.csv`.

[25]

4. Using SAS or R.

The file [Solution_Space_Exploration.csv](#) contains experimental results pertaining to two approaches to solving an optimisation problem (aiming to minimize a cost function). These two approaches will be referred to as approach A and approach B. Approach B involves searching a space that contains the solution space that approach A searches. Thus approach B can at least match approach A.

Every row of the data file corresponds to a given instance of the optimisation problem and contains 6 variables which are (in order):

- A boolean variable indicating **True** if approach B finds a better solution than approach A: **B_optimal**;
- The first dimension of the problem: **m**;
- The second dimension of the problem: **n**;

- A further problem parameter: `tau`;
 - The optimal cost function obtained using method **A**: `A_Cost`;
 - The optimal cost function obtained using method **B**: `B_Cost`;
- i. Give summary statistics for all the variables. [5]
 - ii. Obtain a 3 dimensional representation (eg surface or contour) showing the proportion of times that method **B** finds a better solution based on the dimensions of the problem. [5]
 - iii. Obtain a distribution of the gains made by method **B** over method **A**. [10]
 - iv. Explore and attempt to indicate parameters that influence the performance of either method (and when method **B** is better). [10]