

Victoria Price

2315903

ACCB5021 Statistical

Programming

Data Manipulation

11/11/25

Introduction

In this assignment, I was asked to create an R Script in which I create a data frame that includes the first 200 Pell and Fibonacci numbers. With these numbers, I was asked to create code that calculated the approximation for the first 200 terms, the approximation to $\sqrt{2}$ and the accuracy of the approximation. I also computed the difference between the figures. These calculations were created using loops, and not the `apply()` function.

Through this report, I will outline each section of code, the testing that I completed, and I will also reflect on this assignment including what went well and the challenges that I faced.

Fibonacci and Pell numbers are both recursive sequences. Since I created the script for this assignment from the beginning, I was able to understand step by step the meaning and method for each section of the task.

Explanation of my Code

Task 1.1

For this task, I prepared my script by creating empty vectors for all data in preparation for the data frame. I then stated the first two figures for the Fibonacci and Pell sequence and then wrote my loop. I learned that recurring loops would not be able to run without first defining the initial figures since it uses the previous numbers to run the equation. Initially, I did not set the first figures, so I was only getting back an error.

```
1 nrow <- 200
2
3 f[1]<- 1
4 f[2]<- 1
5 p[1]<- 1
6 p[2]<- 2
7
8 for (n in 3:nrow) {
9   f[n] <- f[n-1] + f[n-2]
10 }
11
12 for (n in 3:nrow) {
13   p[n] <- 2*p[n-1] + p[n-2]
14 }
```

This loop performs the equation on each of the previous number (3 to 200) and outputs the result. This loop structure ensures that each equation is performed in order of the sequence. For testing, I ran the equations and checked through all results to see if there were any NA results. There were none. I also checked the first 10 figures to confirm that they were correct and that gave me confidence in the rest of the output.

Task 1.2

Task 2 requested that I calculate the approximation of the Pell numbers to $\sqrt{2}$. I once again used a loop for this calculation and tested the output by printing the first 10 figures again and confirming that they were close but increasing.

```
30 approximation[n] = (p[n] + p[n-1]) / p[n] #eq
31
32 for (n in 2:nrow) { #continuing the e
33   approximation[n] <- (p[n] + p[n-1]) / p[n]
34 }
35 approximation[1] <- 1 # declaration of the fi
```

Task 1.3

As requested, I ensured that all results for this task were rounded to 5 decimal places. Initially, I thought there was something wrong with my code since I was repeatedly getting the results of 0. As explained further into this report, I explain how I was able to understand the output that I should be expecting. Since the difference gets smaller, I expected a lot of the results to be 0.00000. Results at the beginning had a lot higher of a result that further into the sequence, the higher that the 'n' figure got.

```
37 square <- sqrt(2) #the actual square value
38
39 for (n in 1:nrow) { #loop to calculate the difference bet
40   difference[n] <- round(approximation[n] - square, 5)
41 }
42
```

Task 1.4

Task 4 requested for the R script to include a calculation that checked how many decimal places matched $\sqrt{2}$ exactly. I created a nested loop for this task that would continue if the figures were identical. If they were not, the equation would stop, or in R, break. Printing examples of this loop also assisted me with checking that the results were accurate. I then collated all results from all vectors into one data frame titled pelldata.

```

43 for (n in 1:nrow) { #equation for the accuracy between the two figure
44   acc <- 0
45   for (b in 0:15) { #checks how many figures match between the 1st an
46     if (identical(round(approximation[n], b), round(square, b))) {
47       acc <- b
48     } else {
49       break #stops checking the figures if they don't match
50     }
51   }
52   accuracy[n] <- acc
53 }
54 pelldata <- data.frame( #creation of the data frame
55   N = 1:nrow,
56   F = f,
57   P = p,
58   Approximation = approximation,
59   Difference = difference,
60   Accuracy = accuracy, #inputting all calculations and figures into t
61   stringsAsFactors = FALSE
62 )

```

Reflection

Through the process of creating this R script and data frame, I did notice struggles throughout the creation process. I tried to minimise this as much as possible by creating outputs of approximately the first 10 results and checking them to ensure the output is what I expected. Only testing the first 10 of the equation made it easier for me to comprehend what figures were correct, and what I needed to review and adjust. I felt a lot more comfortable creating loops for the equations since I can see step-by-step what I want the system to do. I did face an initial challenge when starting my loop, by not setting the initial conditions. I have used ChatGPT as a tool to assist with explaining errors I faced in RStudio. It confirmed and explained that I need to index the initial figures, and once I did that and altered the loop to start from the third figure, I felt confident in the output.

Another challenge that I faced was the output format of the Pell and Fibonacci numbers. At first, I thought that the equation was incorrect and I was unsure why the figures that came out were so long. Once I had queried with ChatGPT, it explained that because of the sheer length of the results, it was printing in scientific notation.

As mentioned above, I did use Generative IA through this assignment, but mainly as a tool to help explain the challenges I faced in my code and how I could fix the issues that I faced. All the final code was created and checked myself, to ensure I understood the equations, the outputs and the processes that I had to use.

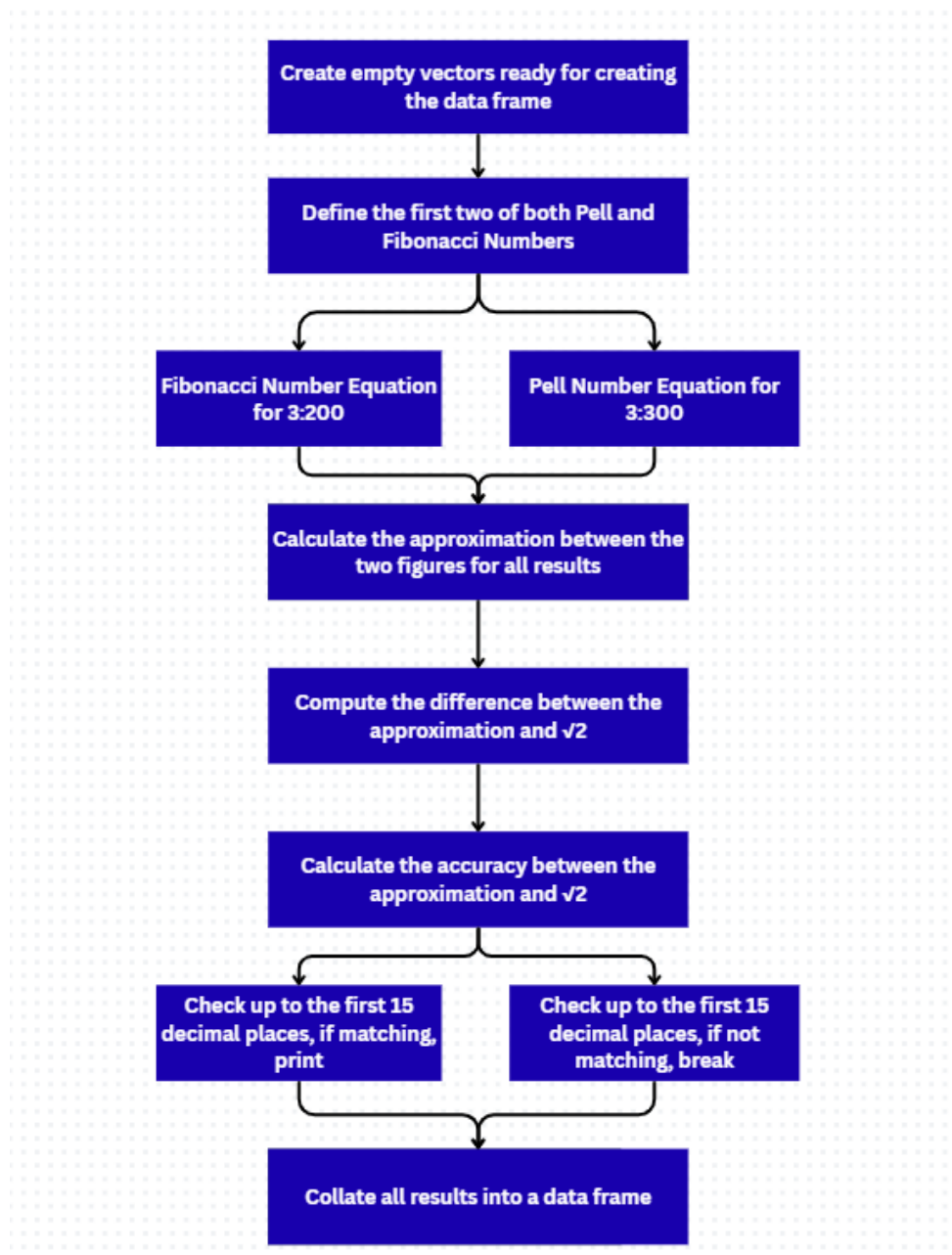
I did struggle with putting each of the results into a data frame step-by-step using cbind, so instead I have collated them at the end of the code. Even after referring to AI, I was still unable to get the testing to work the way that I expected, it was only producing 0 for certain

equations. Instead, I decided to just collate them into one data frame at the end of the script.

I did also refer to the presentations that were provided to me after all lectures I attended on this topic to assist with the use of loops and data frames. The presentations clearly outlined the core methods that I would need to use to put together this assignment.

Overall, I have developed my understanding of using loops and how to structure them efficiently, efficient ways to test equations and understanding the way that R outputs certain figures. If I were to complete the assignment again, I would do more research into the cbind function and ensure that I would break down each section of the task as soon as possible to make sure I fully know what I am expected to output.

Flow Chart



Here is the flowchart that I created to show step-by-step instructions for each section of the R Script. Laying out each section and understanding the process and tasks that needed to be completed, helped me to fully understand what was requested of me for this assignment.