

Designing a program to detect mutations in the human gene using python, application software engineering principles to obtain a real life application while maintaining simplicity of design

## Preface

We will implement an application that detects Mutation in Human DNA Codons, two types are to be investigated here: Point and Insertion mutations.

Following the system design, we use python as the implementation language, where dictionaries are the main structure that will meet our program needs.

The menu driven graphical user interface used in the application is the tkinter which comes with the python by default and doesn't need extra libraries or installations to use, the python version used is 3.5.1

## Flow Charts

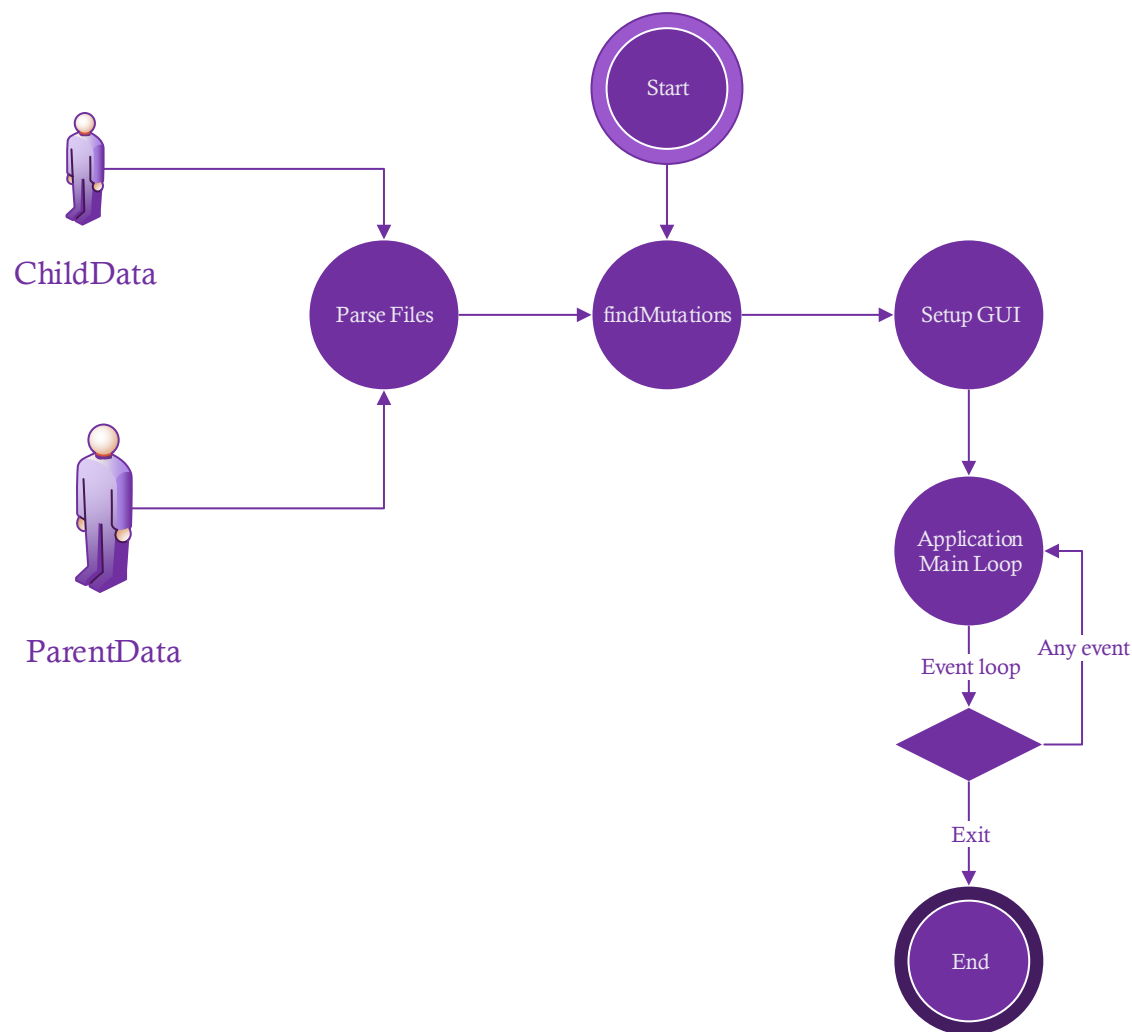


Figure 1: Overall Flow chart of the program.

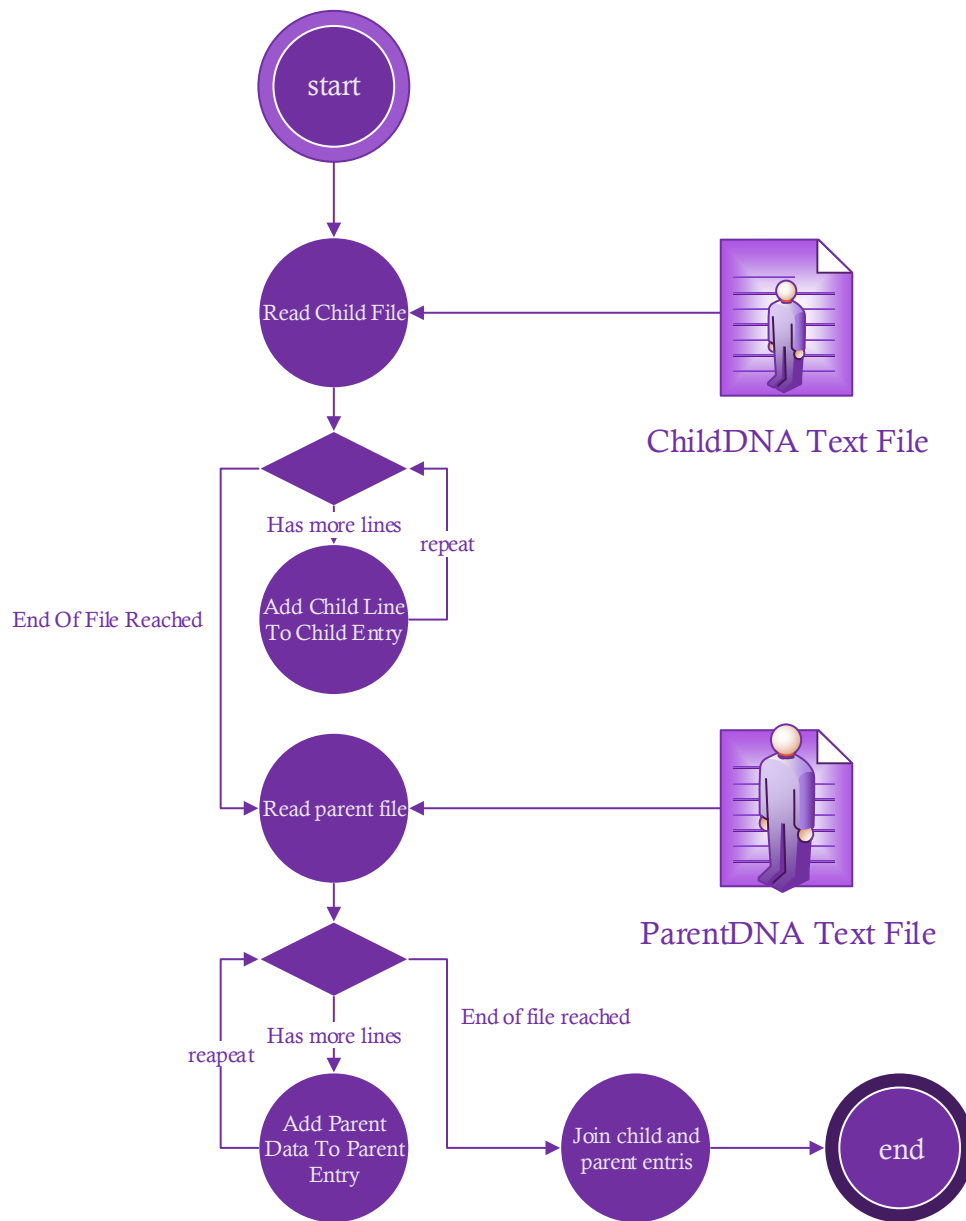


Figure 2: Parse Data Files

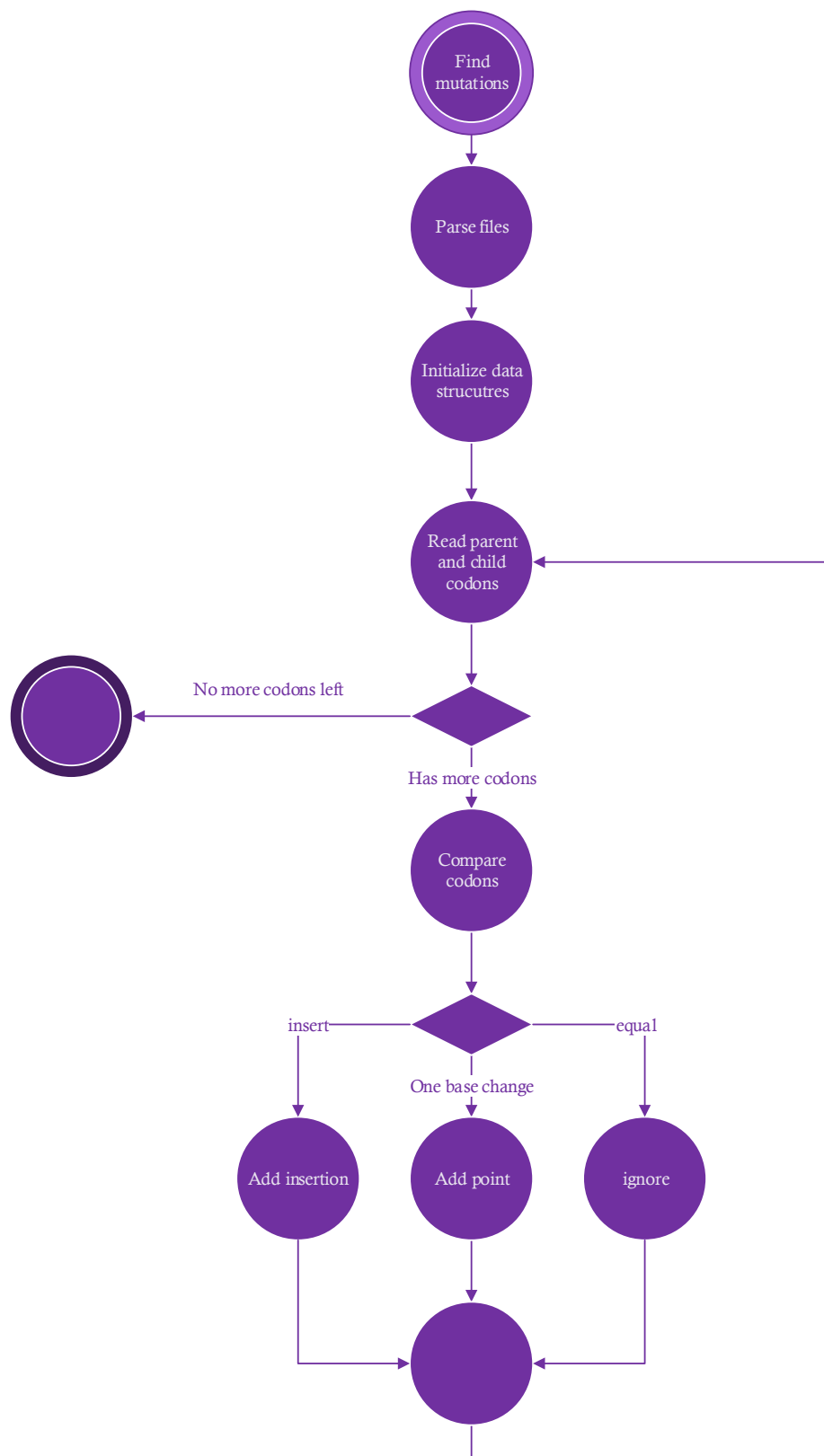


Figure 3: Find Mutations

## Psudo code:

The main functions we have can be summarized as the following pseudo code

### ***def parseFile ():***

```
sampleData={} #contains two arrays, child and parent
open parent and child files
cData=[] #child array
pData=[] #parent array of dictionary values
for each line get child sample data
for each line get parent data
add data subsets to the data dictionary and return it
Close files
```

### ***Def findMutations():***

```
data=parseFiles()
cData=data["Child"]
pData=data["Parent"]
list=[] # dict of{name,sex,mutation index,desc} key is the name
#for each line in the data
    #read data
    # for each three chars in the dna sequence
        #if parent codon!= child codon then it is a mutation
            #if it is one base change then add a point mutation
            # Else add insertion mutation
    # add remaining codons as insertion mutation
```

### ***def setupGUI():***

```
app = AppWindow(None)
app.title('DNA Mutations')
initialize application and setup controls and their events
app.mainloop()
```

**Data Structures:** all are dictionary bases data structures.

## Tests and Results

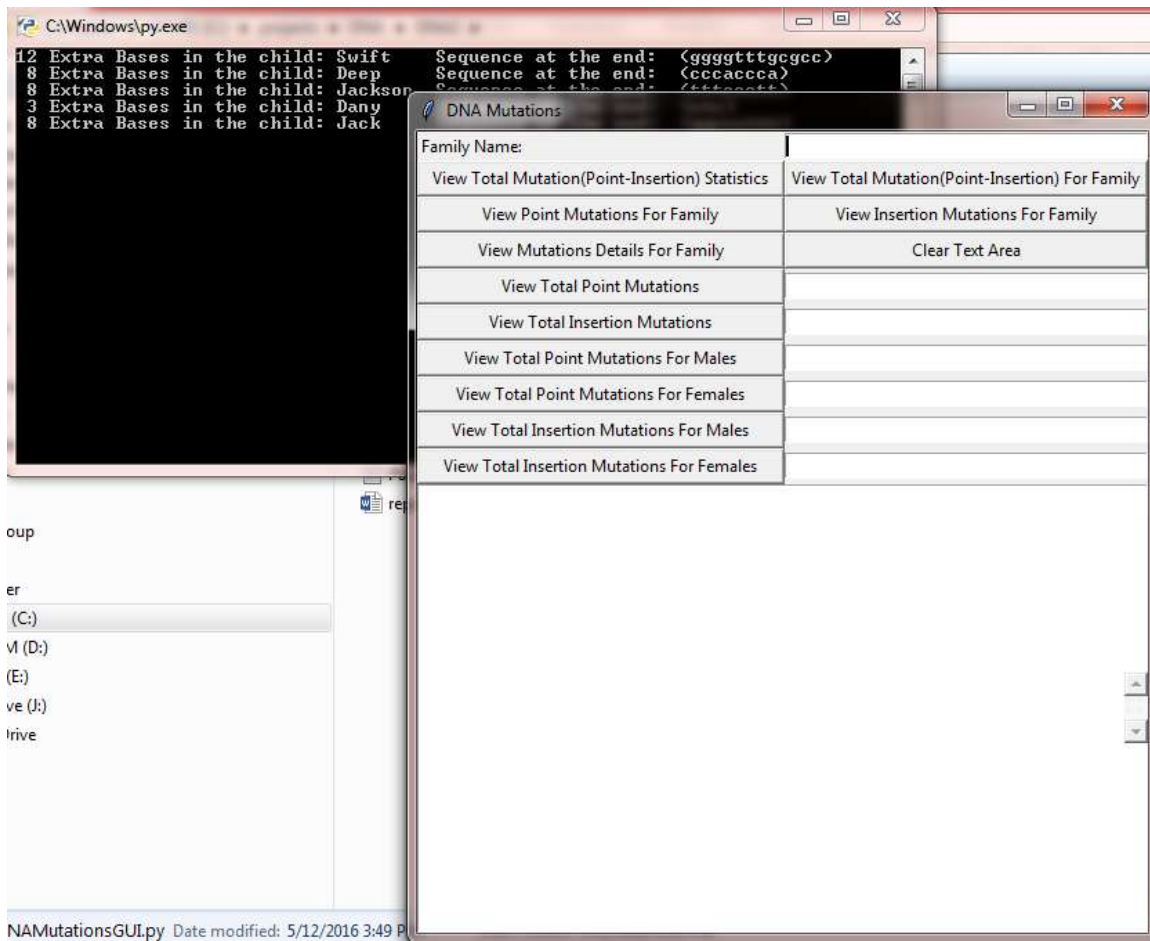


Figure 4: First Running the application

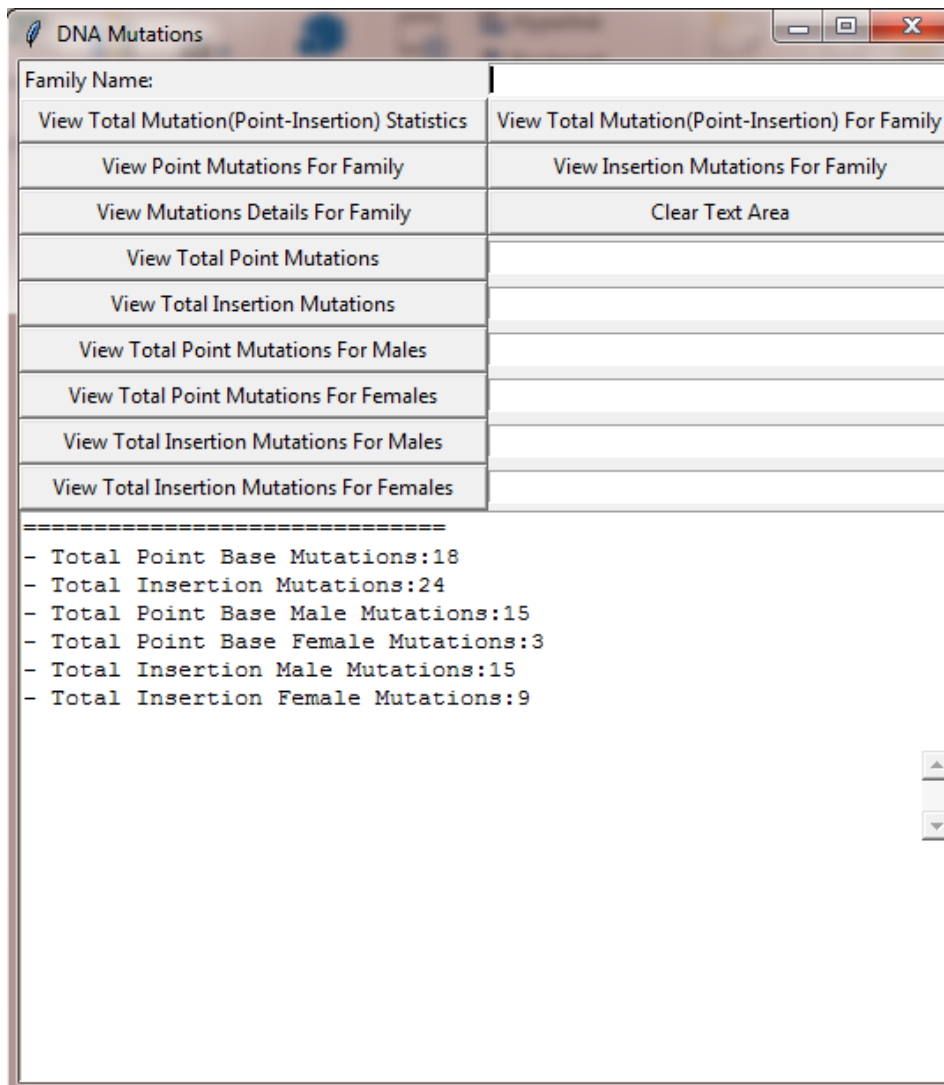


Figure 5: Viewing General Statistics about the sample files



Figure 6: Error Messages, clicking a family related button without entering a family name

DNA Mutations

Family Name: Jackson

View Total Mutation(Point-Insertion) Statistics

View Total Mutation(Point-Insertion) For Family

View Point Mutations For Family

View Insertion Mutations For Family

View Mutations Details For Family

Clear Text Area

View Total Point Mutations

View Total Insertion Mutations

View Total Point Mutations For Males

View Total Point Mutations For Females

View Total Insertion Mutations For Males

View Total Insertion Mutations For Females

```


=====
- Total Point Base Mutations:18
- Total Insertion Mutations:24
- Total Point Base Male Mutations:15
- Total Point Base Female Mutations:3
- Total Insertion Male Mutations:15
- Total Insertion Female Mutations:9
=====
* Total Point Base Mutations for Jackson :4
* Total Insertion Mutations for Jackson :3
* Total Mutations for Jackson :7
=====
SEX      NAME      Index      TYPE      DESCRIPTION
Male     Jackson      2 POINT    cgg==>ggg [R==>G]
Male     Jackson      9 POINT    tgc==>cgc [C==>R]
Male     Jackson     12 POINT    cac==>ccc [H==>P]
Male     Jackson     15 POINT    gtt==>gat [V==>D]

```

Figure 7: Point Mutations for the Jackson Family

| SEX  | NAME    | Index | TYPE      | DESCRIPTION |
|------|---------|-------|-----------|-------------|
| Male | Jackson | 19    | INSERTION | [ttt]       |
| Male | Jackson | 20    | INSERTION | [ccc]       |
| Male | Jackson | 21    | INSERTION | [tt         |
|      |         |       |           | ]           |

Figure 8: Insertion Mutations for the Jackson Family

 DNA Mutations

Family Name:

Jackson

View Total Mutation(Point-Insertion) Statistics

View Total Mutation(Point-Insertion) For Family

View Point Mutations For Family

View Insertion Mutations For Family

View Mutations Details For Family

Clear Text Area

View Total Point Mutations

18

View Total Insertion Mutations

24

View Total Point Mutations For Males

15

View Total Point Mutations For Females

3

View Total Insertion Mutations For Males

15

View Total Insertion Mutations For Females

9

=====

- Total Point Base Mutations:18

- Total Insertion Mutations:24

- Total Point Base Male Mutations:15

- Total Point Base Female Mutations:3

- Total Insertion Male Mutations:15

- Total Insertion Female Mutations:9

Figure 9: viewing individual totals for the files compared.