Introduction

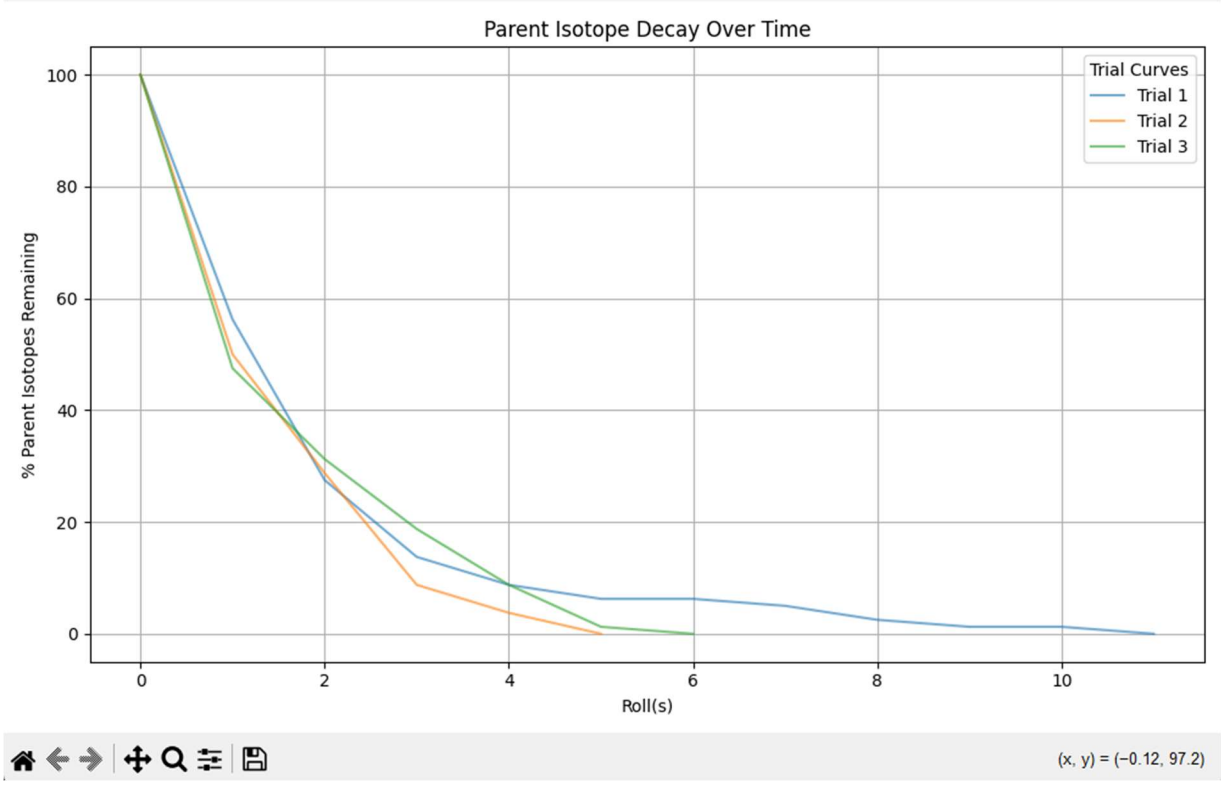
In this document, I'll walk you through what the program does if you run it.
This example will show you the output if you choose the Odd/Even decay experiment and run 3 trials. You can, of course, choose more or fewer trials depending on what you want.

Odd/Even Example (3 Trials)

After selecting the Odd/Even option and choosing 3 trials, the program will output something like this in the terminal:

```
============================================================
              WELCOME TO THE DICE DECAY SIMULATION
============================================================
This simulation models radioactive decay using virtual dice.
You'll choose a decay rule and see how 'parent isotopes' decay over time.
Each roll simulates the passage of time. Have fun!!


Choose an experiment to run (3 to exit):

1:  Odd (Parent) / Even (Daughter)
2:  1-5 (Parent) / 6 (Daughter)

Enter choice (1 or 2): 1

How many trials do you want to run? 3

=== Trial 1 (Odd (Parent) / Even (Daughter)) ===
Roll(s) Dice Left   Parents   Daughters   % Parents Left    % Daughters Left    Prob (decay)
0       80          80        0           100.00            0.00                0.0000
-------------------------------------------------------------------------------------------
1       80          45        35          56.25             43.75               0.4375
2       45          22        23          27.50             72.50               0.5111
3       22          11        11          13.75             86.25               0.5000
4       11          7         4           8.75              91.25               0.3636
5       7           5         2           6.25              93.75               0.2857
6       5           5         0           6.25              93.75               0.0000
7       5           4         1           5.00              95.00               0.2000
8       4           2         2           2.50              97.50               0.5000
9       2           1         1           1.25              98.75               0.5000
10      1           1         0           1.25              98.75               0.0000
11      1           0         1           0.00              100.00              1.0000

=== Trial 2 (Odd (Parent) / Even (Daughter)) ===
Roll(s) Dice Left   Parents   Daughters   % Parents Left    % Daughters Left    Prob (decay)
0       80          80        0           100.00            0.00                0.0000
-------------------------------------------------------------------------------------------
1       80          40        40          50.00             50.00               0.5000
2       40          23        17          28.75             71.25               0.4250
3       23          7         16          8.75              91.25               0.6957
4       7           3         4           3.75              96.25               0.5714
5       3           0         3           0.00              100.00              1.0000

=== Trial 3 (Odd (Parent) / Even (Daughter)) ===
Roll(s) Dice Left   Parents   Daughters   % Parents Left    % Daughters Left    Prob (decay)
0       80          80        0           100.00            0.00                0.0000
-------------------------------------------------------------------------------------------
1       80          38        42          47.50             52.50               0.5250
2       38          25        13          31.25             68.75               0.3421
3       25          15        10          18.75             81.25               0.4000
4       15          7         8           8.75              91.25               0.5333
5       7           1         6           1.25              98.75               0.8571
6       1           0         1           0.00              100.00              1.0000
```

Once the simulation finishes, a graph window will pop up showing the decay curves for each trial:



1-5 / 6 Example (Different Decay Rule)

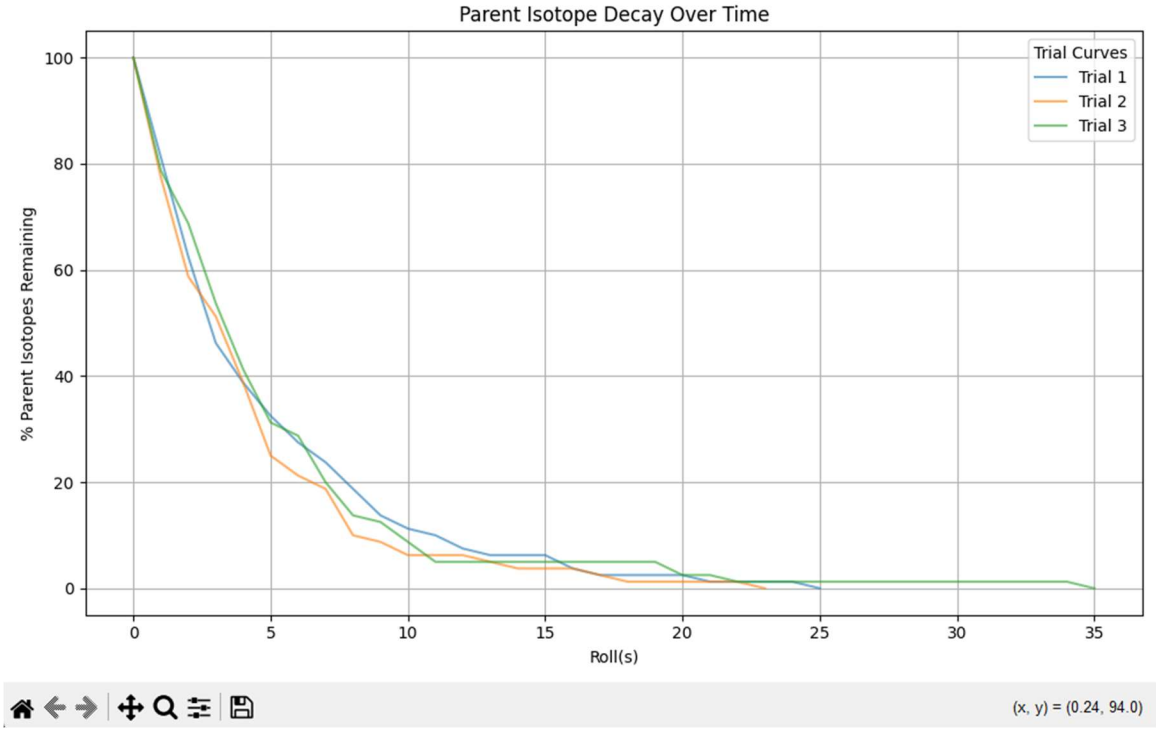
This example shows what happens if you choose the 1-5 (Parent) / 6 (Daughter) decay logic:

Upon launching the program, the terminal will display (I'm only showing the terminal output for trials 1-2, to show you the idea of what it'll look like) :

```
============================================================
               WELCOME TO THE DICE DECAY SIMULATION
============================================================
This simulation models radioactive decay using virtual dice.
You'll choose a decay rule and see how 'parent isotopes' decay over time.
Each roll simulates the passage of time. Have fun!!


Choose an experiment to run (3 to exit):

1:  Odd (Parent) / Even (Daughter)
2:  1-5 (Parent) / 6 (Daughter)

Enter choice (1 or 2): 2

How many trials do you want to run? 3
```

```
=== Trial 1 (1-5 (Parent) / 6 (Daughter)) ===
Roll(s) Dice Left   Parents   Daughters   % Parents Left    % Daughters Left    Prob (decay)
0       80          80        0           100.00            0.00                0.0000
-------------------------------------------------------------------------------------------
1       80          65        15          81.25             18.75               0.1875
2       65          50        15          62.50             37.50               0.2308
3       50          37        13          46.25             53.75               0.2600
4       37          31        6           38.75             61.25               0.1622
5       31          26        5           32.50             67.50               0.1613
6       26          22        4           27.50             72.50               0.1538
7       22          19        3           23.75             76.25               0.1364
8       19          15        4           18.75             81.25               0.2105
9       15          11        4           13.75             86.25               0.2667
10      11          9         2           11.25             88.75               0.1818
11      9           8         1           10.00             90.00               0.1111
12      8           6         2           7.50              92.50               0.2500
13      6           5         1           6.25              93.75               0.1667
14      5           5         0           6.25              93.75               0.0000
15      5           5         0           6.25              93.75               0.0000
16      5           3         2           3.75              96.25               0.4000
17      3           2         1           2.50              97.50               0.3333
18      2           2         0           2.50              97.50               0.0000
19      2           2         0           2.50              97.50               0.0000
20      2           2         0           2.50              97.50               0.0000
21      2           1         1           1.25              98.75               0.5000
22      1           1         0           1.25              98.75               0.0000
23      1           1         0           1.25              98.75               0.0000
24      1           1         0           1.25              98.75               0.0000
25      1           0         1           0.00              100.00              1.0000

=== Trial 2 (1-5 (Parent) / 6 (Daughter)) ===
Roll(s) Dice Left   Parents   Daughters   % Parents Left    % Daughters Left    Prob (decay)
0       80          80        0           100.00            0.00                0.0000
-------------------------------------------------------------------------------------------
1       80          62        18          77.50             22.50               0.2250
2       62          47        15          58.75             41.25               0.2419
3       47          41        6           51.25             48.75               0.1277
4       41          31        10          38.75             61.25               0.2439
5       31          20        11          25.00             75.00               0.3548
6       20          17        3           21.25             78.75               0.1500
7       17          15        2           18.75             81.25               0.1176
8       15          8         7           10.00             90.00               0.4667
9       8           7         1           8.75              91.25               0.1250
10      7           5         2           6.25              93.75               0.2857
11      5           5         0           6.25              93.75               0.0000
12      5           5         0           6.25              93.75               0.0000
13      5           4         1           5.00              95.00               0.2000
14      4           3         1           3.75              96.25               0.2500
15      3           3         0           3.75              96.25               0.0000
16      3           3         0           3.75              96.25               0.0000
17      3           2         1           2.50              97.50               0.3333
18      2           1         1           1.25              98.75               0.5000
19      1           1         0           1.25              98.75               0.0000
20      1           1         0           1.25              98.75               0.0000
21      1           1         0           1.25              98.75               0.0000
22      1           1         0           1.25              98.75               0.0000
23      1           0         1           0.00              100.00              1.0000
```

And then the program will generate a graph showing the decay curves for this logic setup:



Pushing the Limits (Large Number of Trials)

Now, for fun, let's push the limits a little.
Here, I chose option 2 (1-5 / 6) but ran 9,999 trials.

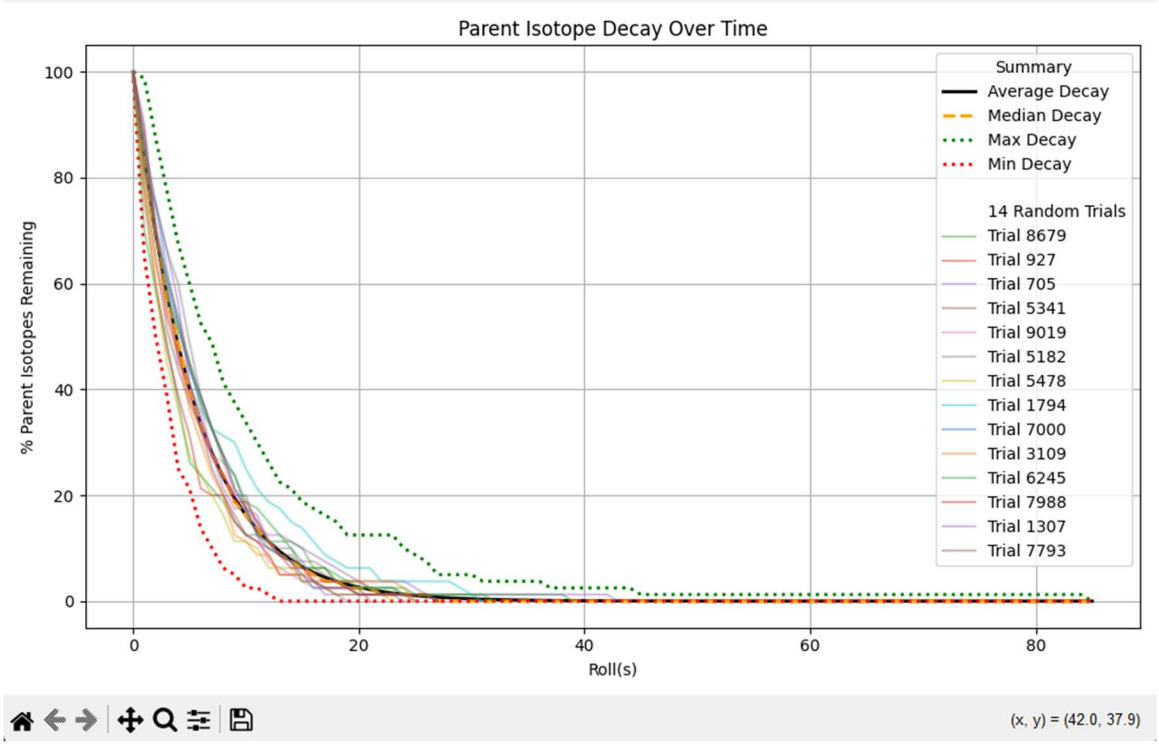
Note: The number of trials you can run depends on the processing power of your computer. It may take a few minutes (or longer) to process large numbers like this.

The terminal will output a lot of data, every single trial and the information associated to it, but for this example, I'm only showing the output for trial number 9,999 (because I'm sure you don't want to scroll through all of them!).

```
=== Trial 9999 (1-5 (Parent) / 6 (Daughter)) ===
Roll(s) Dice Left   Parents   Daughters   % Parents Left    % Daughters Left    Prob (decay)
0       80          80        0           100.00            0.00                0.0000
-------------------------------------------------------------------------------------------
1       80          67        13          83.75             16.25               0.1625
2       67          58        9           72.50             27.50               0.1343
3       58          52        6           65.00             35.00               0.1034
4       52          41        11          51.25             48.75               0.2115
5       41          35        6           43.75             56.25               0.1463
6       35          29        6           36.25             63.75               0.1714
7       29          23        6           28.75             71.25               0.2069
8       23          16        7           20.00             80.00               0.3043
9       16          13        3           16.25             83.75               0.1875
10      13          8         5           10.00             90.00               0.3846
11      8           5         3           6.25              93.75               0.3750
12      5           5         0           6.25              93.75               0.0000
13      5           2         3           2.50              97.50               0.6000
14      2           2         0           2.50              97.50               0.0000
15      2           2         0           2.50              97.50               0.0000
16      2           2         0           2.50              97.50               0.0000
17      2           1         1           1.25              98.75               0.5000
18      1           1         0           1.25              98.75               0.0000
19      1           1         0           1.25              98.75               0.0000
20      1           0         1           0.00              100.00              1.0000
```

Then the program will plot a graph displaying:
-The Average decay curve
- The Median decay curve
- The Maximum and Minimum decay curves
- Plus 14 random trials to illustrate the decay paths

Here’s what that graph would look like:



Final Thoughts

Hopefully, this walkthrough gives you a good idea of what this program can do!

Whether you’re running a few trials or thousands, the simulator is built to adapt and display the results cleanly.
If you run into any bugs, have suggestions, or just want to say hi, feel free to open an issue thread on GitHub!

Have fun and good luck with your experiments!