Simulation Project

- Name - Panos Salouras
- Class period - 7th
- Problem number - 3
- Problem text - A couple plans to have children until they have a girl or until they have four children, whichever comes first. Estimate the likelihood that they will have a girl. Assume that each child has probability 0.5 of being a girl and 0.5 of being a boy, and the sexes of successive children are independent.

Single Trial Setup

```
In [1]: # Write code to run a single trial
        # Refer to your World Series Simulation as a resource!

        import numpy as np

        single_child = np.random.randint(1,101)

        if (single_child <=50):
            print("Boy is Born")
        else:
            print("Girl is Born")
```

```
Girl is Born
```

Single Trial Function

```
In [2]: # Define a function that runs a single trial and returns its result appropriat
        ely
        def have_baby():
            single_child = np.random.randint(1,101)
            if (single_child <= 50):
                return "Boy"
            else:
                return "Girl"
        print(have_baby())
```

```
Girl
```

Full Simulation

- Make sure you simulate a large number of trials!

```
In [87]:  # Run your single trial a large number of times
          # Record your data in an array
          def have_children():
              import numpy as np

              boy_born = 0
              girl_born = 0
              babys_born = 0

              while girl_born == 0:
                  baby_born = have_baby()
                  if baby_born == "Boy":
                      boy_born = boy_born + 1
                      babys_born = babys_born + 1

                      if girl_born >= 1 or babys_born >= 4:
                          return(boy_born,girl_born,babys_born)
                  else:
                      girl_born = girl_born + 1
                      babys_born = babys_born + 1

                      if girl_born >= 1 or babys_born >= 4:
                          return(boy_born,girl_born,babys_born)

          print(have_children())
```

(4, 0, 4)

Calculate the Results

```
In [94]:  # Using the results array, grab appropriate data and perform the necessary cal
          culations
          babys_born_results = []

          girls = 0
          boys = 0
          girls_and_boys_array = []

          for i in range(100):
              babys_born_results.append(have_children())
              if babys_born_results[i] == (4,0,4):
                  boys = boys + 1
              else:
                  girls = girls + 1
          girls_and_boys_array = [boys,girls]
          print(babys_born_results)
          print(girls_and_boys_array)
```

```
[(2, 1, 3), (1, 1, 2), (2, 1, 3), (0, 1, 1), (0, 1, 1), (1, 1, 2), (1, 1, 2),
(1, 1, 2), (0, 1, 1), (1, 1, 2), (4, 0, 4), (0, 1, 1), (0, 1, 1), (0, 1, 1),
(1, 1, 2), (0, 1, 1), (1, 1, 2), (2, 1, 3), (1, 1, 2), (1, 1, 2), (0, 1, 1),
(2, 1, 3), (0, 1, 1), (0, 1, 1), (1, 1, 2), (0, 1, 1), (2, 1, 3), (0, 1, 1),
(1, 1, 2), (4, 0, 4), (2, 1, 3), (0, 1, 1), (0, 1, 1), (4, 0, 4), (3, 1, 4),
(1, 1, 2), (0, 1, 1), (1, 1, 2), (0, 1, 1), (1, 1, 2), (1, 1, 2), (1, 1, 2),
(1, 1, 2), (4, 0, 4), (2, 1, 3), (0, 1, 1), (0, 1, 1), (1, 1, 2), (2, 1, 3),
(0, 1, 1), (0, 1, 1), (1, 1, 2), (2, 1, 3), (0, 1, 1), (1, 1, 2), (0, 1, 1),
(1, 1, 2), (1, 1, 2), (0, 1, 1), (1, 1, 2), (4, 0, 4), (0, 1, 1), (1, 1, 2),
(1, 1, 2), (0, 1, 1), (1, 1, 2), (0, 1, 1), (1, 1, 2), (0, 1, 1), (0, 1, 1),
(0, 1, 1), (4, 0, 4), (0, 1, 1), (1, 1, 2), (2, 1, 3), (0, 1, 1), (0, 1, 1),
(2, 1, 3), (4, 0, 4), (0, 1, 1), (0, 1, 1), (0, 1, 1), (1, 1, 2), (1, 1, 2),
(0, 1, 1), (2, 1, 3), (0, 1, 1), (3, 1, 4), (0, 1, 1), (0, 1, 1), (0, 1, 1),
(0, 1, 1), (0, 1, 1), (2, 1, 3), (4, 0, 4), (0, 1, 1), (0, 1, 1), (0, 1, 1),
(0, 1, 1), (0, 1, 1)]
[8, 92]
```

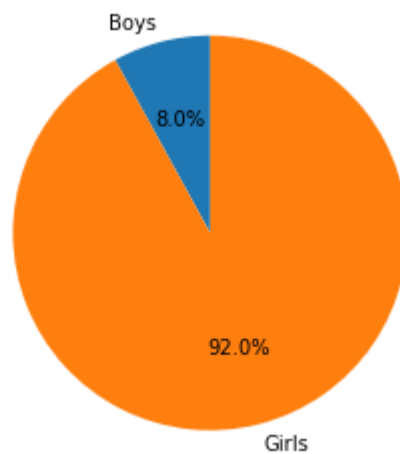## Display the Results

```
In [95]: # Graphically display results related directly to your question
         import matplotlib.pyplot as plt
         %matplotlib inline
         labels = ["Boys", "Girls"]

         explode = (0, 0)

         fig1,ax1 = plt.subplots()

         ax1.pie(girls_and_boys_array, explode, labels, autopct='%1.1f%%', startangle=9
         0)
         ax1.axis('equal')

         plt.show()
```

Boys

8.0%

92.0%

Girls

Answer

There is a 92% chance they will have a girl because out of 100 times of running the program 92 times they have a girl and sometimes some boys and the 8% is having no girls only boys

Additional Question

Out of 100 times how many times do they get 3 boys and 1 girl?

Calculate the Results

```
In [114]:  # Using the results array, grab appropriate data and perform the necessary cal
           culations
           babys_born_results = []

           four_children = 0
           no_four_children = 0
           children_array = []

           for i in range(100):
                   babys_born_results.append(have_children())
                   if babys_born_results[i] == (3,1,4):
                       four_children = four_children + 1
                   else:
                       no_four_children = no_four_children + 1
           children_array = [four_children,no_four_children]
           print(babys_born_results)
           print(children_array)
```

```
[(3, 1, 4), (3, 1, 4), (1, 1, 2), (0, 1, 1), (4, 0, 4), (1, 1, 2), (0, 1, 1),
(0, 1, 1), (1, 1, 2), (1, 1, 2), (0, 1, 1), (1, 1, 2), (0, 1, 1), (0, 1, 1),
(0, 1, 1), (3, 1, 4), (0, 1, 1), (3, 1, 4), (0, 1, 1), (0, 1, 1), (0, 1, 1),
(0, 1, 1), (3, 1, 4), (2, 1, 3), (4, 0, 4), (0, 1, 1), (1, 1, 2), (0, 1, 1),
(1, 1, 2), (0, 1, 1), (0, 1, 1), (0, 1, 1), (0, 1, 1), (1, 1, 2), (0, 1, 1),
(4, 0, 4), (1, 1, 2), (0, 1, 1), (0, 1, 1), (0, 1, 1), (0, 1, 1), (0, 1, 1),
(0, 1, 1), (1, 1, 2), (1, 1, 2), (3, 1, 4), (0, 1, 1), (1, 1, 2), (0, 1, 1),
(0, 1, 1), (0, 1, 1), (1, 1, 2), (0, 1, 1), (1, 1, 2), (1, 1, 2), (2, 1, 3),
(0, 1, 1), (0, 1, 1), (0, 1, 1), (0, 1, 1), (2, 1, 3), (0, 1, 1), (0, 1, 1),
(2, 1, 3), (1, 1, 2), (0, 1, 1), (2, 1, 3), (0, 1, 1), (0, 1, 1), (0, 1, 1),
(0, 1, 1), (0, 1, 1), (1, 1, 2), (0, 1, 1), (0, 1, 1), (2, 1, 3), (0, 1, 1),
(0, 1, 1), (0, 1, 1), (0, 1, 1), (1, 1, 2), (1, 1, 2), (2, 1, 3), (0, 1, 1),
(0, 1, 1), (0, 1, 1), (0, 1, 1), (1, 1, 2), (1, 1, 2), (0, 1, 1), (1, 1, 2),
(1, 1, 2), (3, 1, 4), (0, 1, 1), (4, 0, 4), (0, 1, 1), (0, 1, 1), (0, 1, 1),
(0, 1, 1), (0, 1, 1)]
[7, 93]
```
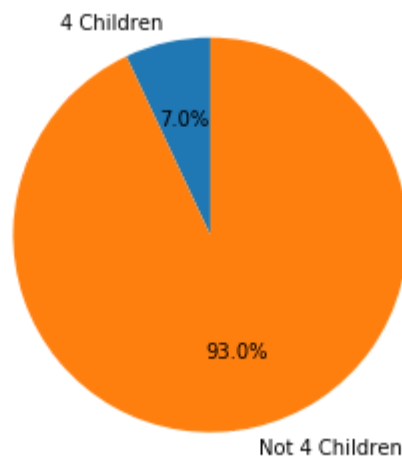
Display the Results

```
In [115]:  # Graphically display results related directly to your question
           # Graphically display results related directly to your question
           import matplotlib.pyplot as plt
           %matplotlib inline
           labels = ["4 Children", "Not 4 Children"]

           explode = (0, 0)

           fig1,ax1 = plt.subplots()

           ax1.pie(children_array, explode, labels, autopct='%1.1f%%', startangle=90)
           ax1.axis('equal')

           plt.show()
```


In [ ]: