

```

In[139]:= (* Coin flip, problem 3 *)

In[140]:= (* Assumption: Coin radius is 1, height is 1 *)

In[141]:= (* Time to go back to initial height *)

In[142]:= timeFunction[v_] := 2 v / 9.8
          timeFunction[4.5]

Out[143]= 0.918367

In[144]:= (* Angular velocity is in radians *)
          (* converts angular velocity to degrees per second *)
          angularToDegrees[a_] := N[a * (180 / Pi)]

In[145]:= (* Function to find where the coin is roated once it falls back into initial height *)
          finalDegrees[timetofunction_, degrees_] := timetofunction * degrees

          (* Reduces the finalDegrees into a value from 0 to 360 degrees *)
          reducetobounds[finaldegrees_] := finaldegrees - (360 * Floor[finaldegrees / 360])

          (* Takes a reduced degree and finds if it will land heads or tails. 1 = heads,
          0 = tails *)
          headsortails[reducedDegree_] := If[(reducedDegree > 270 || reducedDegree < 90), 1, 0]

In[148]:= (* This is where I am going to introduce error *)

In[149]:= (* To land on the side, the coin needs to rotate exactly 90 or 270 degrees *)
          (* However this will never happen as the
          precision of my calculation always has a decimal *)
          (* Instead of rounding to the nearest n-th degree, I am going to take a ratio *)
          (* If reducedDegree/90 or reducedDegree/270 is between .999 and 1.001,
          it lands on its side *)
          (* 1 = lands on side, 0 = no *)

```

```
In[150]:= side[reducedDegree_] := If[(reducedDegree/90 ≥ .999 && reducedDegree/90 ≤ 1.001) ||
    (reducedDegree/270 ≥ .999 && reducedDegree/270 ≤ 1.001)), 1, 0];
```

```
(* Implement a function to use all the above functions. Takes in
    a velocity and an angular momentum. 1 = heads, 0 = tails, 2 = side *)
coinFlip[v_, w_] := (
    time = timeFunction[v];
    degrees = angularToDegrees[w];
    totalDegrees = finalDegrees[time, degrees];
    actualDegree = reducetobounds[totalDegrees];
    If[side[actualDegree] == 1, Return[2], Return[headsortails[actualDegree]]])
```

```
headsListv = {};
headsListw = {};
tailsListv = {};
tailsListw = {};
sideListv = {};
sideListw = {};
```

```
In[158]:=
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```
In[159]:= a = 0;
b = 0;
```

```
In[161]:= While[a < 100,
    While[b < 100,
        result = coinFlip[a, b];
        If[result == 1, (AppendTo[headsListv, a]; AppendTo[headsListw, b])];
        If[result == 0, (AppendTo[tailsListv, a]; AppendTo[tailsListw, b])];
        If[result == 2, (AppendTo[sideListv, a]; AppendTo[sideListw, b])];
        b = b + 1
    ];
    b = 0;
    a = a + 1
];
```

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In[162]:=
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In[163]:=
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