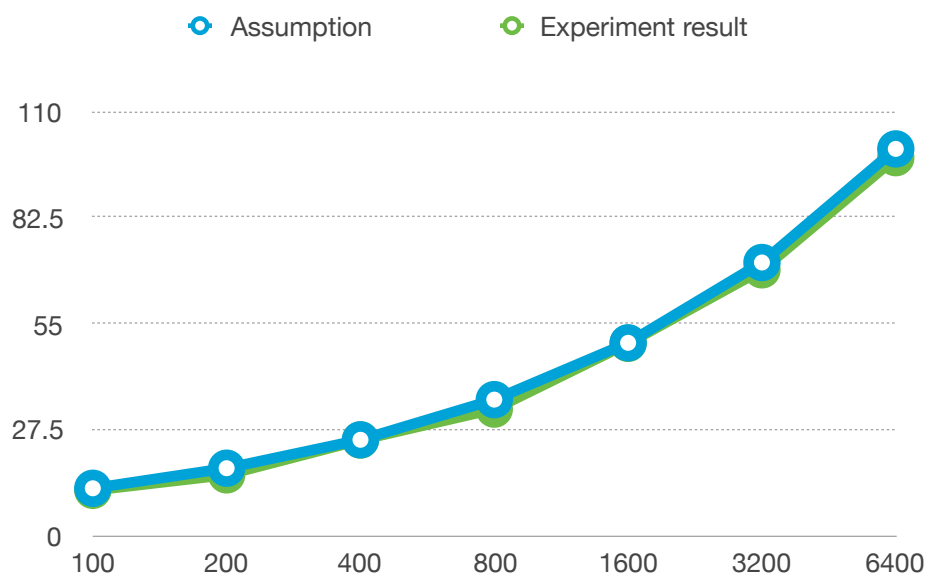
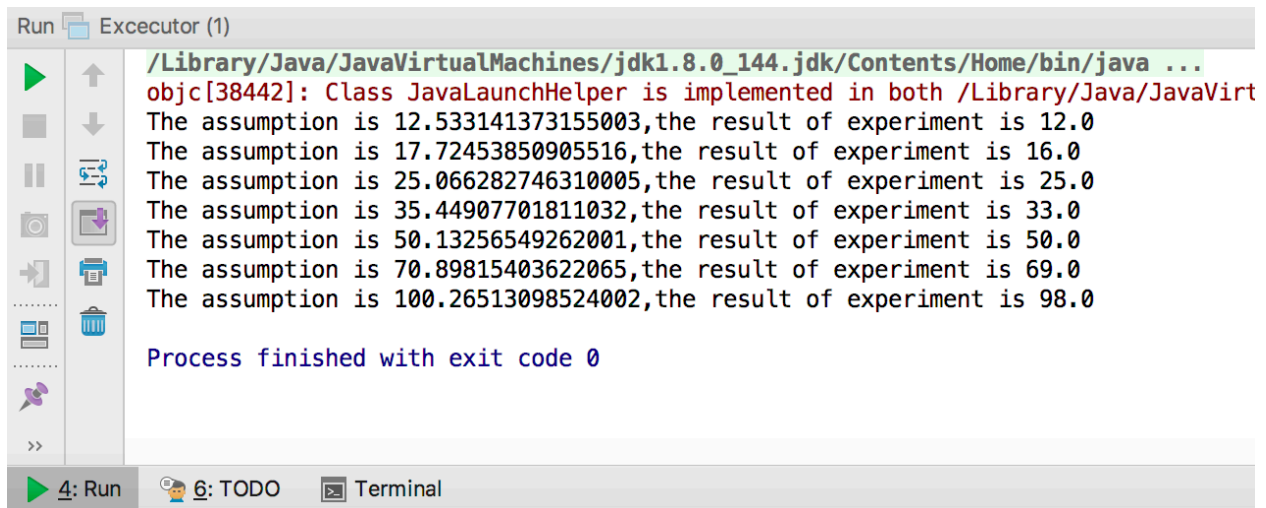


# Assignment 5: Birthdays and Picture Cards

## Birthday problem

Birthday Problem		
M	ASSUMPTION	EXPERIMENT RESULT
100	12.533141373155003	12
200	17.72453850905516	16
400	25.066282746310005	25
800	35.44907701811032	33
1600	50.13256549262001	50
3200	70.89815403622065	69
6400	100.26513098524002	98



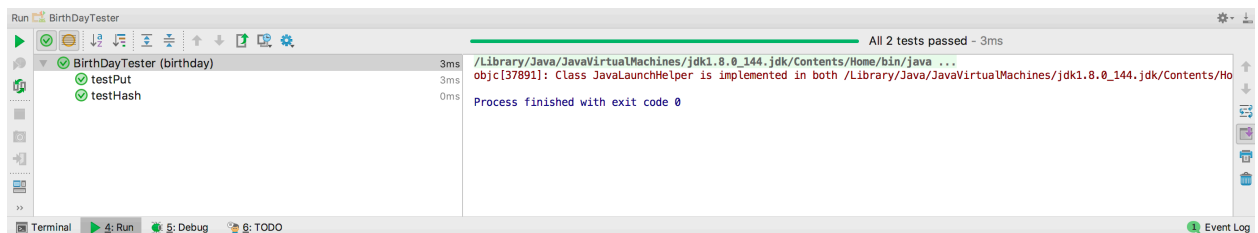


The screenshot shows the 'Run' window of an IDE. The title bar says 'Run' and 'Excecutor (1)'. On the left is a toolbar with icons for running, stepping through, and other execution controls. The main area displays the following text:

```
/Library/Java/JavaVirtualMachines/jdk1.8.0_144.jdk/Contents/Home/bin/java ...  
objc[38442]: Class JavaLaunchHelper is implemented in both /Library/Java/JavaVirt  
The assumption is 12.533141373155003,the result of experiment is 12.0  
The assumption is 17.72453850905516,the result of experiment is 16.0  
The assumption is 25.066282746310005,the result of experiment is 25.0  
The assumption is 35.44907701811032,the result of experiment is 33.0  
The assumption is 50.13256549262001,the result of experiment is 50.0  
The assumption is 70.89815403622065,the result of experiment is 69.0  
The assumption is 100.26513098524002,the result of experiment is 98.0  
  
Process finished with exit code 0
```

At the bottom, there are tabs for '4: Run', '6: TODO', and 'Terminal'.

## Test result:



The screenshot shows the 'Run' window of an IDE with the title 'Run BirthDayTester'. The toolbar on the left includes icons for running, stepping through, and other execution controls. The main area displays the following information:

All 2 tests passed - 3ms

Test Name	Duration
BirthDayTester (birthday)	3ms
testPut	3ms
testHash	0ms

Below the table, the following text is shown:

```
/Library/Java/JavaVirtualMachines/jdk1.8.0_144.jdk/Contents/Home/bin/java ...  
objc[37891]: Class JavaLaunchHelper is implemented in both /Library/Java/JavaVirtualMachines/jdk1.8.0_144.jdk/Contents/Ho  
Process finished with exit code 0
```

At the bottom, there are tabs for 'Terminal', '4: Run', '5: Debug', '6: TODO', and 'Event Log'.

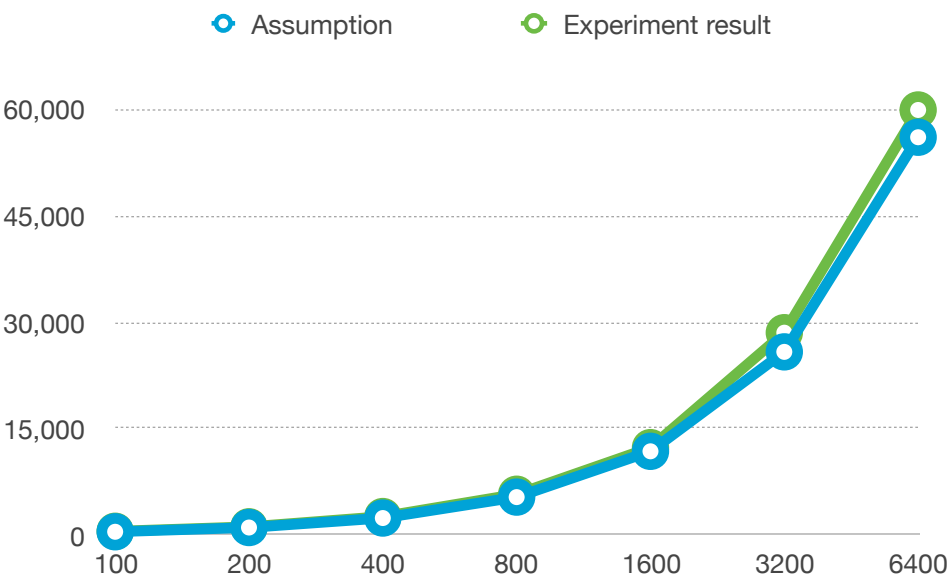
## Conclusion:

According to the above results, we can know that with M growing, the ratio between assumptions and experiment results is extra overlapped, so we can prove our assumption.

# Coupon Collector 's problem

Coupon Collector Problem

M	ASSUMPTION	EXPERIMENT RESULT
100	460.51701859880916	533
200	1059.6634733096073	1,163
400	2396.5858188431926	2,607
800	5347.689382134342	5,753
1600	11804.414253164596	12,323
3200	25826.89948412102	28532
6400	56089.94092382568	59937



```
Run Executor
5347.689382134342
11804.414253164596
25826.89948412102
56089.94092382568
The M is 100. The assumption is 460.51701859880916,the result of experiment is 533.0. The ratio between them is 0.8640094157576157
The M is 200. The assumption is 1059.6634733096073,the result of experiment is 1163.0. The ratio between them is 0.9111465806617431
The M is 400. The assumption is 2396.5858188431926,the result of experiment is 2607.0. The ratio between them is 0.9192887682559235
The M is 800. The assumption is 5347.689382134342,the result of experiment is 5753.0. The ratio between them is 0.929547954481895
The M is 1600. The assumption is 11804.414253164596,the result of experiment is 12323.0. The ratio between them is 0.9579172484918117
The M is 3200. The assumption is 25826.89948412102,the result of experiment is 28532.0. The ratio between them is 0.9051906450343831
The M is 6400. The assumption is 56089.94092382568,the result of experiment is 59937.0. The ratio between them is 0.9358149544325822
Process finished with exit code 0
```

## Test result:

```
Run CouponCollectorTester
All 3 tests passed - 13ms
CouponCollectorTester (CouponCollector) 13ms /Library/Java/JavaVirtualMachines/jdk1.8.0_144.jdk/Contents/Home/bin/java ...
  testPut 13ms objc[37737]: Class JavaLaunchHelper is implemented in both /Library/Java/JavaVirtualMachines/jdk1.8.0_144.jdk/Contents/Ho
  testHash 0ms
  testOccupy 0ms
Process finished with exit code 0
```

## Conclusion:

With M growing, the ratio between assumptions and experiment results is highly overlapped, so we can prove our assumption.