PSA Assignment 4

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- Main class: Assignment5.java
- Birthday Problem: BdayProblem.java
- Coupon Collector Problem: CouponCollector.java

1. **conclusion about the relationship**

$$C_1(m) \sim \sqrt{\pi m / 2}$$

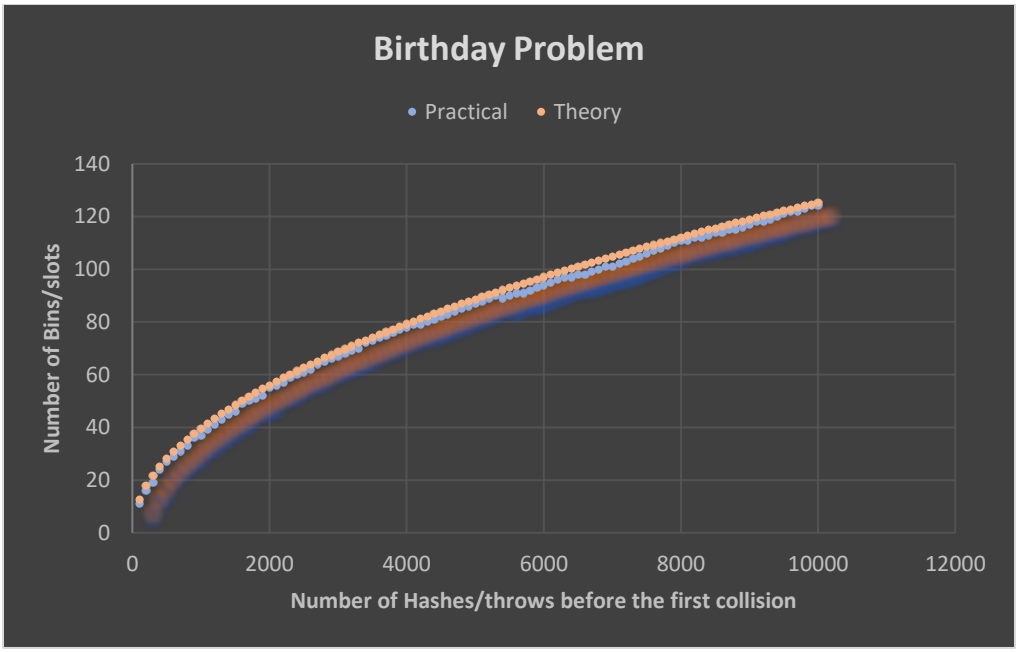
$$B_0(m) \sim m \ln m$$

2. **Your evidence to support that relationship**

	Birthday Problem		coupon collection	
Buckets	**Practical**	**Theory**	**Practical**	**Theory**
100	11	12.52996	514	460.517
500	27	28.01785	3395	3107.304
1000	37	39.62323	7322	6907.755
1500	46	48.52834	11887	10969.83
2000	55	56.0357	16170	15201.8
2500	61	62.64982	20914	19560.12
3000	67	68.62944	25763	24019.1
3500	73	74.12827	31203	28561.81
4000	78	79.24645	37133	33176.2
4500	82	84.05355	40604	37853.25
5000	87	88.60023	46149	42585.97
5500	90	92.9247	51456	47368.77
6000	94	97.05668	56238	52197.09
6500	98	101.0198	61525	57067.12
7000	101	104.8332	66446	61975.66
7500	106	108.5127	71086	66919.94
8000	111	112.0714	79497	71897.57
8500	114	115.5206	83168	76906.48
9000	117	118.8697	85973	81944.82
9500	121	122.127	93168	87010.95
10000	124	125.2996	98382	92103.4

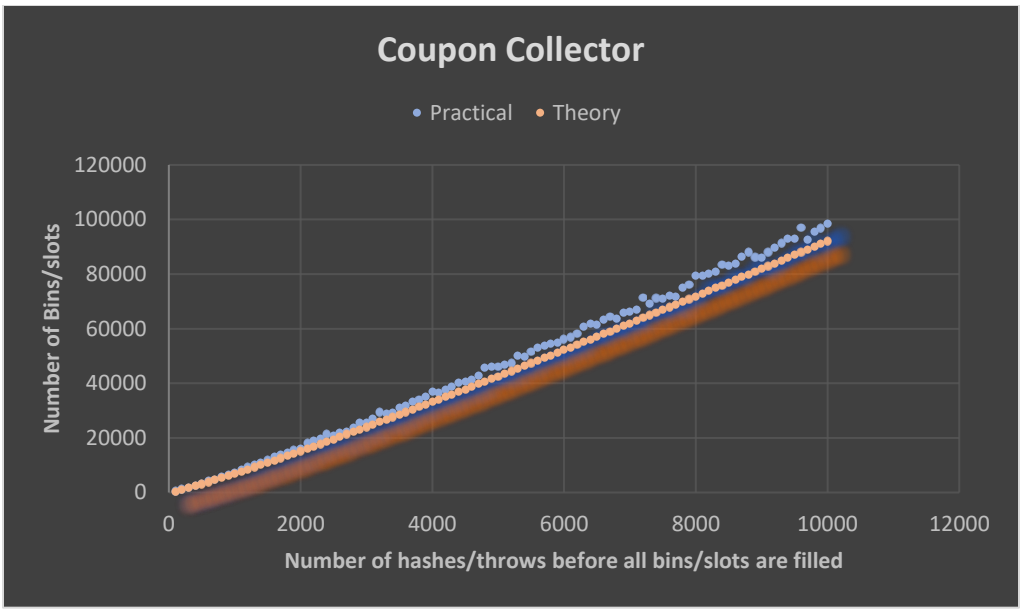
Birthday problem Output:

X axis: Number of Bins/slots
Y axis: number of hashes/throws before the first collision
Values in orange are theoretical values
Values in blue are practical values
The graph shows the relation between practical and theoretical values which are approximately equal.



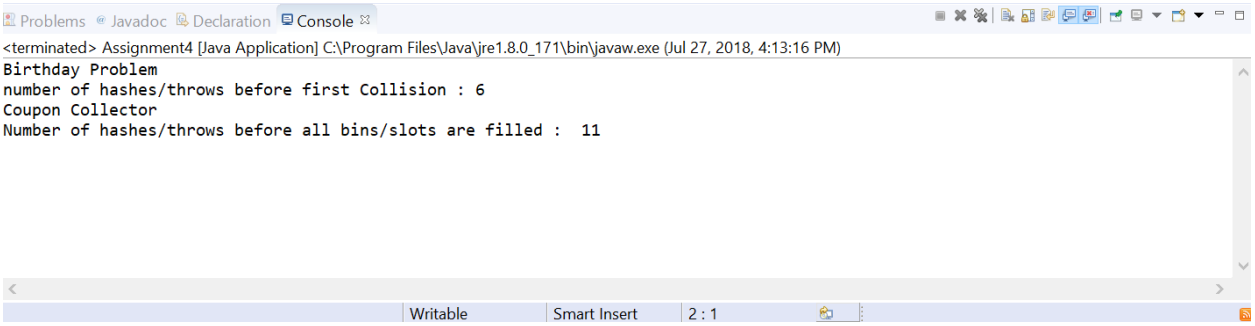
Coupon Collector Problem Output:

X axis: Number of Bins/slots
Y axis: Number of hashes/throws before all bins/slots are filled
Values in orange are theoretical values
Values in blue are practical values
The graph shows the relation between practical and theoretical values which are approximately equal.



Hence practical values were verified against the theoretical values.

Screenshots of the runs

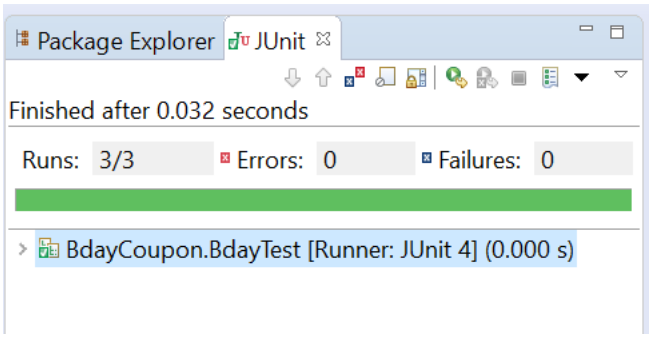


TEST PASSING:

```
 8
 9 public class BdayTest {
10
11
12     @Test
13        public void testFind0() {
14            BdayProblem bp = new BdayProblem(10);
15            assertEquals(7, bp.happyBirthday());
16        }
17
18     @Test
19        public void testFind1() {
20            BdayProblem bp = new BdayProblem(20);
21            assertEquals(6, bp.happyBirthday());
22        }
23
24     @Test
25        public void testFind2() {
```

Problems Javadoc Declaration Console

```
<terminated> BdayTest [JUnit] C:\Program Files\Java\jre1.8.0_171\bin\javaw.exe (Jul 27, 2018, 4:30:07 PM)
number of hashes/throws before first Collision : 7
number of hashes/throws before first Collision : 6
number of hashes/throws before first Collision : 11
```



```java
import static org.junit.Assert.assertEquals;

public class CouponTest {

    @Test
    public void testFind0() {
        CouponCollector cc = new CouponCollector(4);
        cc.add(0, 0);
        cc.add(1, 1);
        cc.add(2, 2);
        cc.add(0, 3);
        cc.add(3, 4);
        cc.n=5;
        assertEquals(5, cc.coupon());
    }

@Test
    public void testFind1() {
     CouponCollector cc = new CouponCollector(6);
```

Problems Javadoc Declaration Console

<terminated> CouponTest [JUnit] C:\Program Files\Java\jre1.8.0_171\bin\javaw.exe (Jul 27,

```
Number of hashes/throws before all bins/slots are filled :  5
```