```
 1 import static org.junit.Assert.assertEquals;
 2
 3 import org.junit.Test;
 4
 5 import components.naturalnumber.NaturalNumber;
 6 import components.naturalnumber.NaturalNumber2;
 7
 8 /**
 9  * @author Put your name here
10  *
11  */
12 public class CryptoUtilitiesTest {
13
14     /*
15      * Tests of reduceToGCD
16      */
17
18     @Test
19     public void testReduceToGCD_0_0() {
20         NaturalNumber n = new NaturalNumber2(0);
21         NaturalNumber nExpected = new NaturalNumber2(0);
22         NaturalNumber m = new NaturalNumber2(0);
23         NaturalNumber mExpected = new NaturalNumber2(0);
24         CryptoUtilities.reduceToGCD(n, m);
25         assertEquals(nExpected, n);
26         assertEquals(mExpected, m);
27     }
28
29     @Test
30     public void testReduceToGCD_30_21() {
31         NaturalNumber n = new NaturalNumber2(30);
32         NaturalNumber nExpected = new NaturalNumber2(3);
33         NaturalNumber m = new NaturalNumber2(21);
34         NaturalNumber mExpected = new NaturalNumber2(0);
35         CryptoUtilities.reduceToGCD(n, m);
36         assertEquals(nExpected, n);
37         assertEquals(mExpected, m);
38     }
39
```

```
40      @Test
41      public void testReduceToGCD_1_2() {
42          NaturalNumber n = new NaturalNumber2(1);
43          NaturalNumber nExpected = new NaturalNumber2(1);
44          NaturalNumber m = new NaturalNumber2(2);
45          NaturalNumber mExpected = new NaturalNumber2(0);
46          CryptoUtilities.reduceToGCD(n, m);
47          assertEquals(nExpected, n);
48          assertEquals(mExpected, m);
49      }
50
51      @Test
52      public void testReduceToGCD_19_121() {
53          NaturalNumber n = new NaturalNumber2(19);
54          NaturalNumber nExpected = new NaturalNumber2(1);
55          NaturalNumber m = new NaturalNumber2(121);
56          NaturalNumber mExpected = new NaturalNumber2(0);
57          CryptoUtilities.reduceToGCD(n, m);
58          assertEquals(nExpected, n);
59          assertEquals(mExpected, m);
60      }
61
62      @Test
63      public void testReduceToGCD_20_99() {
64          NaturalNumber n = new NaturalNumber2(20);
65          NaturalNumber nExpected = new NaturalNumber2(1);
66          NaturalNumber m = new NaturalNumber2(99);
67          NaturalNumber mExpected = new NaturalNumber2(0);
68          CryptoUtilities.reduceToGCD(n, m);
69          assertEquals(nExpected, n);
70          assertEquals(mExpected, m);
71      }
72
73      @Test
74      public void testReduceToGCD_12_60() {
75          NaturalNumber n = new NaturalNumber2(12);
76          NaturalNumber nExpected = new NaturalNumber2(12);
77          NaturalNumber m = new NaturalNumber2(60);
78          NaturalNumber mExpected = new NaturalNumber2(0);
```

```
 79         CryptoUtilities.reduceToGCD(n, m);
 80         assertEquals(nExpected, n);
 81         assertEquals(mExpected, m);
 82     }
 83 
 84     /*
 85      * Tests of isEven
 86      */
 87 
 88     @Test
 89     public void testIsEven_0() {
 90         NaturalNumber n = new NaturalNumber2(0);
 91         NaturalNumber nExpected = new NaturalNumber2(0);
 92         boolean result = CryptoUtilities.isEven(n);
 93         assertEquals(nExpected, n);
 94         assertEquals(true, result);
 95     }
 96 
 97     @Test
 98     public void testIsEven_1() {
 99         NaturalNumber n = new NaturalNumber2(1);
100         NaturalNumber nExpected = new NaturalNumber2(1);
101         boolean result = CryptoUtilities.isEven(n);
102         assertEquals(nExpected, n);
103         assertEquals(false, result);
104     }
105 
106     @Test
107     public void testIsEven_2() {
108         NaturalNumber n = new NaturalNumber2(2);
109         NaturalNumber nExpected = new NaturalNumber2(2);
110         boolean result = CryptoUtilities.isEven(n);
111         assertEquals(nExpected, n);
112         assertEquals(true, result);
113     }
114 
115     @Test
116     public void testIsEven_5() {
117         NaturalNumber n = new NaturalNumber2(5);
```

```
118         NaturalNumber nExpected = new NaturalNumber2(5);
119         boolean result = CryptoUtilities.isEven(n);
120         assertEquals(nExpected, n);
121         assertEquals(false, result);
122     }
123 
124     @Test
125     public void testIsEven_10() {
126         NaturalNumber n = new NaturalNumber2(10);
127         NaturalNumber nExpected = new NaturalNumber2(10);
128         boolean result = CryptoUtilities.isEven(n);
129         assertEquals(nExpected, n);
130         assertEquals(true, result);
131     }
132 
133     /*
134      * Tests of powerMod
135      */
136 
137     @Test
138     public void testPowerMod_0_0_2() {
139         NaturalNumber n = new NaturalNumber2(0);
140         NaturalNumber nExpected = new NaturalNumber2(1);
141         NaturalNumber p = new NaturalNumber2(0);
142         NaturalNumber pExpected = new NaturalNumber2(0);
143         NaturalNumber m = new NaturalNumber2(2);
144         NaturalNumber mExpected = new NaturalNumber2(2);
145         CryptoUtilities.powerMod(n, p, m);
146         assertEquals(nExpected, n);
147         assertEquals(pExpected, p);
148         assertEquals(mExpected, m);
149     }
150 
151     @Test
152     public void testPowerMod_17_18_19() {
153         NaturalNumber n = new NaturalNumber2(17);
154         NaturalNumber nExpected = new NaturalNumber2(1);
155         NaturalNumber p = new NaturalNumber2(18);
156         NaturalNumber pExpected = new NaturalNumber2(18);
```

```
157         NaturalNumber m = new NaturalNumber2(19);
158         NaturalNumber mExpected = new NaturalNumber2(19);
159         CryptoUtilities.powerMod(n, p, m);
160         assertEquals(nExpected, n);
161         assertEquals(pExpected, p);
162         assertEquals(mExpected, m);
163     }
164 
165     @Test
166     public void testPowerMod_20_30_40() {
167         NaturalNumber n = new NaturalNumber2(20);
168         NaturalNumber nExpected = new NaturalNumber2(0);
169         NaturalNumber p = new NaturalNumber2(30);
170         NaturalNumber pExpected = new NaturalNumber2(30);
171         NaturalNumber m = new NaturalNumber2(40);
172         NaturalNumber mExpected = new NaturalNumber2(40);
173         CryptoUtilities.powerMod(n, p, m);
174         assertEquals(nExpected, n);
175         assertEquals(pExpected, p);
176         assertEquals(mExpected, m);
177     }
178 
179     @Test
180     public void testPowerMod_50_60_70() {
181         NaturalNumber n = new NaturalNumber2(50);
182         NaturalNumber nExpected = new NaturalNumber2(50);
183         NaturalNumber p = new NaturalNumber2(60);
184         NaturalNumber pExpected = new NaturalNumber2(60);
185         NaturalNumber m = new NaturalNumber2(70);
186         NaturalNumber mExpected = new NaturalNumber2(70);
187         CryptoUtilities.powerMod(n, p, m);
188         assertEquals(nExpected, n);
189         assertEquals(pExpected, p);
190         assertEquals(mExpected, m);
191     }
192 
193     /*
194      * Tests of isWitnessToCompositenes
195      */
```

```
196
197     @Test
198     public void testisWitnessToCompositeness_0() {
199         NaturalNumber n = new NaturalNumber2(7);
200         NaturalNumber nExpected = new NaturalNumber2(7);
201         NaturalNumber w = new NaturalNumber2(2);
202         NaturalNumber wExpected = new NaturalNumber2(2);
203         boolean result =
    CryptoUtilities.isWitnessToCompositeness(w, n);
204         assertEquals(nExpected, n);
205         assertEquals(wExpected, w);
206         assertEquals(false, result);
207     }
208
209     @Test
210     public void testisWitnessToCompositeness_1() {
211         NaturalNumber n = new NaturalNumber2(5);
212         NaturalNumber nExpected = new NaturalNumber2(5);
213         NaturalNumber w = new NaturalNumber2(3);
214         NaturalNumber wExpected = new NaturalNumber2(3);
215         boolean result =
    CryptoUtilities.isWitnessToCompositeness(w, n);
216         assertEquals(nExpected, n);
217         assertEquals(wExpected, w);
218         assertEquals(false, result);
219     }
220
221     @Test
222     public void testisWitnessToCompositeness_2() {
223         NaturalNumber n = new NaturalNumber2(20);
224         NaturalNumber nExpected = new NaturalNumber2(20);
225         NaturalNumber w = new NaturalNumber2(13);
226         NaturalNumber wExpected = new NaturalNumber2(13);
227         boolean result =
    CryptoUtilities.isWitnessToCompositeness(w, n);
228         assertEquals(nExpected, n);
229         assertEquals(wExpected, w);
230         assertEquals(true, result);
231     }
```

```
232
233     /*
234      * Tests of isPrime2
235      */
236
237     @Test
238     public void testisPrime2_0() {
239         NaturalNumber n = new NaturalNumber2(7);
240         NaturalNumber nExpected = new NaturalNumber2(7);
241         boolean result = CryptoUtilities.isPrime2(n);
242         assertEquals(nExpected, n);
243         assertEquals(true, result);
244     }
245
246     @Test
247     public void testisPrime2_1() {
248         NaturalNumber n = new NaturalNumber2(2);
249         NaturalNumber nExpected = new NaturalNumber2(2);
250         boolean result = CryptoUtilities.isPrime2(n);
251         assertEquals(nExpected, n);
252         assertEquals(true, result);
253     }
254
255     @Test
256     public void testisPrime2_2() {
257         NaturalNumber n = new NaturalNumber2(4);
258         NaturalNumber nExpected = new NaturalNumber2(4);
259         boolean result = CryptoUtilities.isPrime2(n);
260         assertEquals(nExpected, n);
261         assertEquals(false, result);
262     }
263
264     /*
265      * Tests of generateNextLikelyPrime
266      */
267
268     @Test
269     public void testgenerateNextLikelyPrime_0() {
270         NaturalNumber n = new NaturalNumber2(2);
```

```
271         NaturalNumber nExpected = new NaturalNumber2(3);
272         CryptoUtilities.generateNextLikelyPrime(n);
273         assertEquals(nExpected, n);
274     }
275 
276     @Test
277     public void testgenerateNextLikelyPrime_1() {
278         NaturalNumber n = new NaturalNumber2(9);
279         NaturalNumber nExpected = new NaturalNumber2(11);
280         CryptoUtilities.generateNextLikelyPrime(n);
281         assertEquals(nExpected, n);
282     }
283 
284     @Test
285     public void testgenerateNextLikelyPrime_2() {
286         NaturalNumber n = new NaturalNumber2(215);
287         NaturalNumber nExpected = new NaturalNumber2(223);
288         CryptoUtilities.generateNextLikelyPrime(n);
289         assertEquals(nExpected, n);
290     }
291 
292 }
293 
```