

**The University of Newcastle**  
**School of Electrical Engineering and Computer Science**

**COMP3260/6360 Data Security**

**GAME 2**

14<sup>th</sup> March 2019

Number of Questions: 5

Time allowed: 50min

Total mark: 5

In order to score marks you need to show all the workings and not just the end result.

	<i>Student Number</i>	<i>Student Name</i>
<i>Student 1</i>		
<i>Student 2</i>		
<i>Student 3</i>		
<i>Student 4</i>		
<i>Student 5</i>		
<i>Student 6</i>		
<i>Student 7</i>		

<i>Question 1</i>	<i>Question 2</i>	<i>Question 3</i>	<i>Question 4</i>	<i>Question 5</i>	<i>TOTAL</i>

1. Find the GCD of 2,735 and 1,971.

2. Find the inverse of 7 modulo 101.

3. For the equation  $\Phi(x) = y$ ,  $y=1$  has two solutions:  $x=1$  and  $x=2$ . Find all solutions for each of the following.
- a.  $y=2$
  - b.  $y=4$
  - c.  $y=31$

4. Calculate  $\Phi(98)$ .

5. Suppose there are 5 possible messages, A, B, C, D and E, with the probabilities  $p(A) = p(B) = 1/10$ ,  $p(C) = 2/5$ ,  $p(D) = p(E) = 1/5$ . What is the expected number of bits needed to encode these messages in optimal encoding? (That is, find  $H(M)$ .) Provide optimal encoding. Calculate the average number of bits per message for your encoding.

