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| **Name: James Prugh** | **Contact Info:** | **Date:7/15/16** |

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| **Lesson Title : Modular Arithmetic** | **Unit #:** | **Lesson #2:** | **Activity #:3** |
| **Activity Title: Modular Arithmetic** |

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| **Estimated Lesson Duration:** | **1 day** |
| **Estimated Activity Duration:** | **1 day** |

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| **Setting:** | **High school classroom** |

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| **Activity Objectives:** |

1. Students will learn modular arithmetic and use it to generate a shared key using the Diffie-Hellman algorithm.

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| **Activity Guiding Questions:** |

1. What is modular arithmetic?
2. What is clock arithmetic? What does it have to do with encryption? What does it have to do with internet security?

| **Next Generation Science Standards (NGSS)**  |
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| **Science and Engineering Practices (Check all that apply)**  | **Crosscutting Concepts (Check all that apply)** |
| [ ]  Asking questions (for science) and defining problems (for engineering) | [ ]  Patterns |
| [ ]  Developing and using models | [ ]  Cause and effect |
| [ ]  Planning and carrying out investigations | [ ]  Scale, proportion, and quantity |
| [ ]  Analyzing and interpreting data | [ ]  Systems and system models |
| [ ]  Using mathematics and computational thinking | [ ]  Energy and matter: Flows, cycles, and conservation |
| [ ]  Constructing explanations (for science) and designing solutions (for engineering) | [ ]  Structure and function.  |
| [ ]  Engaging in argument from evidence | [ ]  Stability and change.  |
| [ ]  Obtaining, evaluating, and communicating information  |  |

| **Ohio’s Learning Standards for Science (OLS)** |
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| **Expectations for Learning - Cognitive Demands (Check all that apply)** |
| [ ]  Designing Technological/Engineering Solutions Using Science concepts **(T)** |
| [ ]  Demonstrating Science Knowledge **(D)** |
| [ ]  Interpreting and Communicating Science Concepts **(C)** |
| [ ]  Recalling Accurate Science **(R)** |

| **Ohio’s Learning Standards for Math (OLS) and/or** **Common Core State Standards -- Mathematics (CCSS)** |
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| **Standards for Mathematical Practice (Check all that apply)** |
| [x]  Make sense of problems and persevere in solving them | [x]  Useappropriate tools strategically |
| [x]  Reason abstractly and quantitatively | [x]  Attendto precision |
| [x]  Construct viable arguments and critique the reasoning of others | [x]  Look for and make use of structure |
| [x]  Model with mathematics | [x]  Look for and express regularity in repeated reasoning |

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| **Unit Academic Standards (NGSS, OLS and/or CCSS):** |

[CCSS.MATH.CONTENT.HSF.BF.A.1.B](http://www.corestandards.org/Math/Content/HSF/BF/A/1/b/)

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| **Materials**: (Link Handouts, Power Points, Resources, Websites, Supplies) |

<https://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnxqYW1lc3BydWdoMjAxNnxneDo0NTg5ZmY5NGQ0YTcxNDI2>

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| **Teacher Advance Preparation:** |

Bring in analog clock.

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| **Activity Procedures:** |

Students will be divided in groups of 4 and given questions to work on.

**Formative Assessments:** Link the items in the Activities that will be used as formative assessments.

**Summative Assessments:** These are optional; there may be summative assessments at the end of a set of Activities or only at the end of the entire Unit.

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| **Differentiation:** More difficult questions were posed to the students with prior experience in modular arithmetic |

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| **Reflection:** Reflect upon the successes and shortcomings of the lesson. |

I had assumed that students had some experience with clock arithmetic, but I was wrong. This was a bit more difficult than expected, and some students had a hard time getting their mind around a number system with a base other than 10. Once the Diffie-Hellman algorithm was introduced and we discussed the significance of modular arithmetic, the interest level picked up and the activities went well.