

CSE - 015: Homework 6

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1 Modular Exponentiation:

- 1. Compute the binary expansion of 2019
 - Answer: $(2019)_{10} = 11111100011$
 - Binary Expansion: $2^{10} + 2^9 + 2^8 + 2^7 + 2^6 + 2^5 + 2^1 + 2^0$
- 2. Compute $13^{2019} \pmod{37}$
 - Answer: $a^{p-1} = 1 \pmod{p}$
 - $a^{p-1} \pmod{p} = 1$
 - $13^{37-1} \pmod{37} = 1$
 - $13^{36} \pmod{37} = 1$
 - $2019 = 36 \cdot 56 + 3$
 - $13^{2019} \pmod{37} = (13^{36} \pmod{37})^{56} \pmod{37} * 13^3 \pmod{37}$
 - $= (1 \pmod{37}) * (13^3 \pmod{37})$
 - $= (13^3 \pmod{37})$
 - $= 2197 \pmod{37}$
 - $= 14$

2 Greatest Common Divisor

- 1. $\gcd(288, 126)$
 - Answer:
 - $A = 288 \ B = 126$
 - $= \frac{288}{126} = 36$
 - $A = 126 \ B = 36$
 - $= \frac{126}{36} = 18$
 - $A = 36 \ B = 18$
 - $= \frac{36}{18} = 0$
 - $A = 18 \ B = 0$

$$- = \gcd(288, 126) = 18$$

• 2. $\gcd(899, 703)$

- Answer:

$$- A = 889 \ B = 703$$

$$- = \frac{889}{703} = 196$$

$$- A = 703 \ B = 196$$

$$- = \frac{703}{196} = 115$$

$$- A = 196 \ B = 115$$

$$- = \frac{196}{115} = 81$$

$$- A = 115 \ B = 81$$

$$- = \frac{115}{81} = 34$$

$$- A = 81 \ B = 34$$

$$- = \frac{81}{34} = 13$$

$$- A = 34 \ B = 13$$

$$- = \frac{34}{13} = 8$$

$$- A = 13 \ B = 8$$

$$- = \frac{13}{8} = 5$$

$$- A = 8 \ B = 5$$

$$- = \frac{8}{5} = 3$$

$$- A = 5 \ B = 3$$

$$- = \frac{5}{3} = 2$$

$$- A = 3 \ B = 2$$

$$- = \frac{3}{2} = 1$$

$$- A = 2 \ B = 1$$

$$- = \frac{2}{1} = 0$$

$$- A = 1 \ B = 0$$

$$- \gcd(899, 703) = 1$$