HomeWork 6

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1 Modular Exponentiation

1. Compute the binary expansion of 2019

ANSWER:
011111100011

2. Compute the 13^{2019} (mod 37)

WORK:
011111100011

$2^0 + 2^1 + 2^6 + 2^7 + 2^8 + 2^9 + 2^{10} + 2^{11}$

$1 + 2 + 64 + 128 + 256 + 512 + 1024 + 2048$

$13^{(1+2+64+128+256+512+1024+2048)}$ mod 37

$13^1 * 13^2 * 13^{64} * 13^{128} * 13^{256} * 13^{512} * 13^{1024} * 13^{2048}$ mod 37

(13^1 mod 37 $*13^2$ mod 37 $*13^{64}$ mod 37 $*13^{128}$ mod 37 $*13^{256}$ mod 37 $*13^{512}$ mod 37 $*13^{1024}$ mod 37 $*13^{2048}$ mod 37) mod 37

13^{2019} mod $37 = (13 * 21 * 33 * 16 * 34 * 9 * 7 * 12)$ mod 37

ANSWER:
14

2 Greatest Common Divisor

1. gcd(288, 126)

WORK:

$\frac{288}{126} = 2$ R 36

$\frac{126}{36} = 3$ R 18

$\frac{36}{18} = 2$ R 0

ANSWER:

18

2. gcd(899,703)

WORK:

$\frac{899}{703} = 1$ R 196

$\frac{703}{196} = 3$ R 115

$\frac{196}{115} = 1$ R 81

$\frac{115}{81} = 1$ R 34

$\frac{81}{34} = 2$ R 13

$\frac{34}{13} = 2$ R 8

$\frac{13}{8} = 1$ R 5

$\frac{8}{5} = 1$ R 3

$\frac{5}{3} = 1$ R 2

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

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

ANSWER:
1