

Q1 Extended Euclid

2 Points

Consider positive integers x, m , where $\gcd(x, m) = 1$. Assume $a, b \in \mathbb{N}$ satisfies $ax + bm = \gcd(x, m)$.

Q1.1 Multiplicative inverse

1 Point

What is the multiplicative inverse of x modulo m ?

- a
- b
- x
- m

Explanation

Since $ax + bm \equiv 1 \pmod{m}$, we have $ax \equiv 1 - bm \equiv 1 \pmod{m}$.

Q1.2 Another multiplicative inverse

1 Point

What is the multiplicative inverse of m modulo x ?

- a
- b
- x
- m

Explanation

Since $ax + bm \equiv 1 \pmod{x}$, we have $bm \equiv 1 - ax \equiv 1 \pmod{x}$.

Q2 Chinese Remainder Theorem

2 Points

Let n, m be positive integers with $\gcd(n, m) = 1$. Assume $u \equiv n^{-1} \pmod{m}$.

Q2.1

1 Point

What is $u \cdot n \pmod{m}$?

- 0
- 1
- 2
- 3
- 4
- 5

Explanation

u is the multiplicative inverse of n modulo m .

Q2.2

1 Point

What is $u \cdot n \pmod{n}$?

- 0
- 1
- 2
- 3
- 4
- 5

Explanation

Any multiple of n is 0 modulo n .

Q3 What is True

3 Points

Let x, m be positive integers and define $d = \gcd(x, m)$. Check if the following statements are true.

Q3.1

1 Point

x/d is an integer.

True

False

Explanation

Since d is a divisor of x .

Q3.2

1 Point

$\gcd(\frac{x}{d}, m)$ is always 1.

True

False

Explanation

If $x = 8$ and $m = 4$, then $d = 4$ and $\gcd(\frac{x}{d}, m) = \gcd(2, 4) = 2 \neq 1$.

Q3.3

1 Point

$\gcd\left(\frac{x}{d}, \frac{m}{d}\right)$ is always 1.

True

False

Explanation

Since d is the *greatest* common divider.